GREEN BUILDING CERTIFICATION SYSTEM

SUPPLEMENTAL REVIEW OF USGBC'S LEED V4 SYSTEMS:
BD+C: NC, O+M: EB AND ID+C: CI

APPENDICES

PREPARED FOR:
THE U.S. GENERAL SERVICES ADMINISTRATION
OFFICE OF GOVERNMENT-WIDE POLICY
OFFICE OF FEDERAL HIGH-PERFORMANCE GREEN BUILDINGS

GREEN BUILDING CERTIFICATION SYSTEM

APPENDICES

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Appendix A: LEED v. 4 NC Robustness Review

Robustness Key (from section 4.9 of the 2012 Study)	
●	Full circles (green) mean that the Federal requirement would automatically be met if the building was certified because the system and Federal requirements fully align, and the requirement within the green building certification system is a prerequisite.
◕	Three-quarter circles (green) mean that the certification system has an option (e.g.., point, credit, etc.) that meets the Federal Requirement; if that option is included in the certification package, the Federal Requirement would be met.
◑	A half circle (yellow) means the certification system includes an option related to but not directly aligned with the Federal Requirement. The certification systems may have a lower standard, different baselines, different calculation methods, or different ways to document compliance with the Federal Requirement.
○	An empty circle means the Federal Requirement is not an identified component within the certification system.

NOTE: LEED v4 does not number credits in any of the LEED rating system reference guides. However, the USGBC published LEED v4 checklists do contain credit numbers. To facilitate the organization of content, the tables include credit numbers consistent with the nomenclature of the LEED v4 checklists and past LEED rating systems.

Integrative Principles

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Integrated Design			
Does the metric help a building meet a current Federal Requirement?	Integrated Design. Use a collaborative, integrated planning and design process that: • Initiates and maintains an integrated project team as described on the Whole Building Design Guide <http://www.wbdg.org/design/engage_process.php> in all stages of a project's planning and delivery; • Integrates the use of OMB's A-11, Section 7, Exhibit 300: Capital Asset Plan and Business Case Summary; • Establishes performance goals for siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and ensures incorporation of these goals throughout the design and lifecycle of the building; • Considers all stages of the building lifecycle, including deconstruction.	◑	**Summary:** LEED v4 NC contains two credits that are related to but not directly aligned with the Federal Requirements. The Federal Requirements mandate specific processes and activities for integrated design. The LEED v4 NC credit Integrative Process (IP Credit 1) gives specific guidelines for how analysis should be used to inform decision making. While this supports the Federal Requirement to ensure incorporation of performance goals throughout the design and lifecycle of the building, the Federal Requirements contain additional and specific requirements including the establishment of performance goals for siting, materials and indoor environmental quality, and lifecycle considerations that are not addressed in the credit. LEED v4 NC LEED Accredited Professional (IN Credit 2) lists an intent "to encourage the team integration required by a LEED v4 NC project and to streamline the application and certification process." While aligned with the Federal Requirement for an integrated project team, there are no specific performance requirements for the LEED AP to engage an integrated project team. Neither of the credits require the integration of OMB's Capital Asset Planning and Business Case Summary process into the OPR and BOD. **Integrative Process (IP Credit 1) (1 pt.)** Requires the use of analysis to set goals and strategies and inform the Owner's Project Requirements (OPR) document, basis of design (BOD), and design and construction documents. Preliminary energy modeling analysis as well as a water budget analysis are required to set the project on the right path by providing initial feedback on performance to the integrated design team. **LEED Accredited Professional (IN Credit 2) (1 pt.)** Awards credit to the project for the participation of a LEED AP with a specialty appropriate to the project.
Does the certification system help users achieve cost saving through integrated	N/A		The involvement of the LEED AP and associated resources available to project teams are intended to support integrated credit achievement through more integrative thinking and design practices, thereby creating an opportunity for cost-savings.
What is the baseline or point of comparison?	N/A		**IPc1:** N/A **INc2:** N/A
What is the range of requirements to	N/A		**IPc1:** Compliance **INc2:** Compliance

Integrative Principles

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
What standards or tools are required for	N/A		N/A
Commissioning			
Does the metric help a building meet a current Federal Requirement?	Employ commissioning practices tailored to the size and complexity of the building and its system components in order to verify performance of building components and systems and help ensure that design requirements are met. This should include an experienced commissioning provider, inclusion of commissioning requirements in construction documents, a commissioning plan, verification of the installation and performance of systems to be commissioned, and a commissioning report.	●	**Summary:** Projects that achieve Fundamental Commissioning and Verification (EA Prerequisite 1) will meet the Federal Requirements. The prerequisite requires a tailored approach that serves to ensure the design requirements are met, requires an experienced commissioning authority, the inclusion of commissioning requirements in construction documents, a commissioning plan, verification of the installation and testing of systems, and a commissioning report. **Fundamental Commissioning and Verification (EA Prerequisite 1)** Requires the commissioning of mechanical, electrical, plumbing, and renewable energy systems and assemblies, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 by a qualified commissioning authority. The prerequisite also requires that an operations and maintenance plan be developed for ongoing operations. **Enhanced Commissioning (EA Credit 1)** Projects can earn 2-6 points for various levels of additional commissioning activities beyond those required in the prerequisite. Option 1: Enhanced Systems Commissioning (3-4 pts.) Path 1: Enhanced Commissioning (3 pts.) including, for example, additional reviews and verifications such as reviews of contractor submittals, verification of systems manual updates and delivery, as well as verification of seasonal testing, and the development of an on-going commissioning plan Path 2: Enhanced and Monitoring-Based Commissioning (4 pts.) including the development of monitoring-based procedures for energy and water systems. Option 2: Envelope Commissioning (2 pts.) Commissioning of the building envelope following specified requirements as they pertain to energy, water, indoor environmental quality, and durability.
What is the baseline or point of comparison?	N/A		**EAp1:** N/A **EAc1:** N/A
What is the range of requirements to	N/A		**EAp1:** Compliance **EAc1:** Compliance
What standards or tools are required for	N/A		ASHRAE Guideline 0-2005, ASHRAE Guideline 1.1-2007, National Institute of Building Sciences (NIBS) Guideline 3-2012, Exterior Enclosure Technical Requirements for the Commissioning Process
Building System Controls (Not in GP)			

Integrative Principles

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies building system controls as an element of indoor environmental quality to be considered during the certification system review.	◑	**Summary:** LEED v4 NC is related to but does not directly align with the Federal Requirement for building system controls (building automation system). Advanced energy metering can play an important role in a BAS, but does not provide the level of control needed to meet the intent of the requirement. Similarly, mechanical systems designed to maintain comfort within the parameters of ASHRAE 55-2010 provide some building level comfort management, but do not singularly constitute building system controls. There is no requirement for building automation systems in LEED v4 NC. **Building-Level Energy Metering (EA Prerequisite 3)** The prerequisite requires that building-level energy meters are installed (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc.), or sub-meters that have the ability to aggregate data for whole building reporting. All data needs to be shared with the USGBC for a period of 5 years. The USGBC works to reduce disparities between predictive and actual performance by analyzing data and sharing results. **Advanced Energy Metering (EA Credit 3) (1 pt.)** To earn credit, the project must also install meters to energy end uses that represent 10% or more of the total building energy consumption. The data collection system for the advanced metering must use a local area network, building automation system, wireless network, or comparable communication infrastructure. **Thermal Comfort (EQ Credit 5) (1 pt.)** To achieve the credit, projects must be designed to ASHRAE 55-2010 Standard. In addition, LEED v4 NC has combined requirements for controllability of systems with this credit to enhance occupant comfort and well-being. In addition, individual thermal comfort controls need to be provided to at least 50% of individual occupants and also in multioccupant spaces.
What is the baseline or point of comparison?	N/A		**EAp3:** N/A **EAc3:** N/A **EQc5:** ASHRAE 55-2010
What is the range of requirements to achieve the metric?	N/A		**EAp3:** Compliance **EAc3:** Compliance (1 pt.) **EQc5:** Option 1: Compliance (1 pt.) Option 2: Controls for 50% of occupants (1 pt.)

Integrative Principles

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
What standards or tools are required for the metric?	N/A		ASHRAE 55-2010, ISO 7730-2005 Ergonomics of the thermal environment, analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, European Standard EN 15251:2007, indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, Section A2
Siting (Not in GP)			
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies reduced impacts from transportation through building location and site design that promote access by public transportation as an element of indoor environmental quality to be considered during the certification system review.	◕	**Summary**: If either LEED v4 NC Surrounding Density and Diverse Uses (LT Credit 4) or Access to Quality Transit (LT Credit 5) are achieved, the project will meet the Federal Requirement by promoting reduced impacts from transportation through building location and site design that promotes access by public transit. In addition, Bicycle Facilities (LT Credit 6) and Reduced Parking Footprint (LT Credit 7) are related as they support the use of alternative transportation. **Surrounding Density and Diverse Uses (LT Credit 4) (1-5 pts.)** Option 1: (2-3 pts.) Locate the project on a site with a surrounding density that exceeds stated values; 22,000 square feet per acre of buildable land (2 pts.) or 35,000 square feet per acre of buildable land (3 pts.) Option 2: (1-2 pts.) Construct or renovate the project on a site that meets between 2 and 4 of the stated transportation resource requirements such as proximity to a main logistics hub, near highway access, near freight rail access, or a rail spur. **Access to Quality Transit (LT Credit 5) (1-5 pts.)** Locate the project within 1/4 miles of bus, streetcar or rideshare stops, or within a 1/2 mile of bus rapid transit, rail or commuter ferry terminals. Points are awarded based on minimum numbers of weekday and weekend trips.
What is the baseline or point of comparison?	N/A		**LTc4:** Option 1: N/A Option 2: N/A **LTc5:** N/A
What is the range of requirements to achieve the metric?	N/A		**LTc4:** Option 1: 22,000 or 35,000 sf per acre of building land (2-3 pts.) Option 2: proximity to 2-4 transportation resources (1-2 pts.) **LTc5:** proximity to transportation options (1-5 pts.)
What standards or tools are required for	N/A		N/A
Greenhouse Gas (Not in GP)			

Integrative Principles

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	E.O. 13423 and 13514 establish specific targets for agencies in building design, construction and operations in the areas of energy use, water use, greenhouse gas emissions, waste reduction, stormwater management, and facility siting. E.O. 13514 also requires reductions in greenhouse gas emissions.	●	**Summary:** Federal Requirements for Greenhouse Gas emissions pertain to agency-wide goals. As such, they do not have project-specific requirements. LEED v4 NC EA Prerequisite 2 contributes to the Federal Goals for every project that pursues LEED v4 NC. Additionally, Optimize Energy Performance (EA Credit 2), Renewable Energy Production (EA Credit 5), and Green Power and Carbon Offsets (EA Credit 7) are all related to the reduction of greenhouse gas emissions and represent the spectrum of opportunity for reducing GHG emissions from energy use. The credits referenced below represent the spectrum of opportunity for reducing GHG emissions in LEED v4 NC projects. **Minimum Energy Performance (EA Prerequisite 2)** Projects must achieve a 5% reduction for new construction and 3% reduction for major renovation as compared against the ASHRAE 90.1-2010 baseline. The prerequisite also allows two prescriptive compliance paths for qualifying buildings. **Optimize Energy Performance (EA Credit 2) (1-20 pts.)** Up to 20 points may be achieved for improving performance between 6% and 50% (for new construction) and 4%-48% (for major renovations) based on the ASHRAE 90.1-2010 baseline. **Renewable Energy Production (EA Credit 5) (3 pts.)** Credit is awarded for the installation of 1%-10% of renewable energy on-site. Allowable sources of renewable energy include photovoltaic, solar thermal, wind, biofuel (in some cases), low-impact hydroelectricity, wave and tidal energy, and geothermal energy (in some cases). **Green Power and Carbon Offsets (EA Credit 7) (2 pts.)** Qualifying renewable energy credits or carbon offsets may be purchased for 50%-100% of project energy for 5 years to earn points. All RECs must have originated after January 1, 2005. The following LEED Credits also support related reductions of GHG emissions in buildings. They are discussed throughout this document. **Surrounding Density and Diverse Uses (LT Credit 4) (1-5 pts.)** **Access to Quality Transit (LT Credit 5) (1-5 pts.)** **Bicycle Facilities (LT Credit 6) (1 pt.)** **Green Vehicles (LT Credit 8) (1 pt.)** **Fundamental Refrigerant Management (EA Prerequisite 4)** **Enhanced Refrigerant Management (EA Credit 6) (1 pt.)** **Storage and Collection of Recyclables (MR Prerequisite 1)** **Construction and Demolition Waste Management Planning (MR Prerequisite 2)** **Building Life-Cycle Impact Reduction (MR Credit 1) (Option 4) (3 pts.)** **Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 2) (1-2 pts.)** **Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 3) (Option 2) (1 pt.)** **Construction and Demolition Waste Management (MR Credit 5) (1-2 pts.)**
What is the baseline or point of comparison?	**N/A**		**EAp2:** ASHRAE 90.1-2010 **EAc2:** ASHRAE 90.1-2010 **EAc5:** Annual energy cost **EAc7:** Total project energy

Integrative Principles

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
What is the range of requirements to achieve the metric?	N/A		**EAp2:** Compliance **EAc2:** 6%-50% for new construction and 4%-48% for existing building renovations (1-20 pts.) **EAc5:** 1%-10% (1-3 pts.) **EAc7:** 50%-100% (1-2 pts.)
What standards or tools are required for the metric?	N/A		ANSI/ASHRAE/IESNA Standard 90.1-2010, ASHRAE 50% Advanced Energy Design Guide, Advanced Buildings Core Performance Guide, Center for Resource Solutions Green-e Program, Commercial Building Energy Consumption Survey (CBECS)

Energy

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Energy Efficiency			
Does the metric help a building meet a current Federal Requirement?	Establish a whole building performance target that takes into account the intended use, occupancy, operations, plug loads, other energy demands, and design to earn the ENERGY STAR® targets for new construction and major renovation where applicable. For new construction, reduce the energy use by 30% compared to the baseline building performance rating per the ANSI/ASHRAE/IESNA Standard 90.1-2007. For major renovations, reduce the energy use by 20% below pre-renovations 2003 baseline.	●	**Summary:** LEED v4 NC uses the updated ASHRAE 90.1-2010 Standard as the baseline. It is more stringent than the ASHRAE 90.1-2007 Standard referenced in the Federal Requirement. For new buildings, a 5% reduction for new construction and 3% reduction for major renovations is required as part of Minimum Energy Performance (EA Prerequisite 2). Optimize Energy Performance (EA Credit 2) provides points to projects that earn up to a 48% reduction. Because the updated ASHRAE 90.1-2010 Standard is more stringent, if enough points are earned in Optimize Energy Performance (EA Credit 2), the Federal Requirement will be met. An exact number of points that will be required to meet the Federal Requirement can not be determined because each building will have a unique baseline model, based on ASHRAE 90.1-2010, from which energy reductions are achieved. Both new construction and major renovation projects are subject to the same energy modeling process. Prescriptive compliance options in LEED v4 NC Minimum Energy Performance (EA Prerequisite 2) and Optimize Energy Performance (EA Credit 2) are related to, but not directly aligned with the Federal Requirement because they do not require a comparison to a baseline standard and instead rely on the implementation of best practices. A project would have to pursue the performance based options to meet pertinent Federal Requirements. Regarding ENERGY STAR, LEED v4 NC does not require any explicit use or alignment with ENERGY STAR targets. However, one can easily conclude that any project meeting the LEED v4 NC percent reduction targets would be eligible to earn ENERGY STAR certification if the project performs as it is designed (note that ENERGY STAR certification is a metric for existing buildings with actual performance data). If the Federal Requirement is interpreted to mean using the Target Finder tool to develop future energy performance goals, then LEED v4 NC does not have this process requirement. **Minimum Energy Performance (EA Prerequisite 2)** Projects must achieve a 5% reduction for new construction and 3% reduction for major renovation as compared against the ASHRAE 90.1-2010 baseline. The prerequisite also allows two prescriptive compliance paths for qualifying buildings. **Optimize Energy Performance (EA Credit 2) (1-20 pts.)** Up to 20 points may be achieved for improving performance between 6% and 50% (for new construction) and 4%-48% (for major renovations) based on the ASHRAE 90.1-2010 baseline.
What is the baseline or point of comparison?	ASHRAE 90.1-2007; Energy use in 2003		ASHRAE/IESNA 90.1-2010
What is the range of requirements to achieve the metric?	30%; 20%		**EAp2:** 5% reduction new construction and 3% reduction for major renovations. **EAc2:** 6%-50% for new construction and 4%-48% for existing building renovations (1-20 pts.)
What standards or tools are required for the metric?	ASHRAE 90.1-2007		ANSI/ASHRAE/IESNA Standard 90.1-2010, ASHRAE 50% Advanced Energy Design Guide, Advanced Buildings Core Performance Guide
On-Site Renewable Energy & Green Power			

Energy			
Review Questions	**Federal Requirements (NC)**		**LEED v4 BD+C: New Construction (2014 Update)**
Does the metric help a building meet a current Federal Requirement?	Per the Energy Independence and Security Act (EISA) Section 523, meet at least 30% of the hot water demand through the installation of solar hot water heaters, when lifecycle cost effective. The 2013 Presidential Memorandum on Federal Leadership in Energy Management requires that agencies meet 20% of total electric energy consumption through renewable sources by fiscal year 2020. The Memorandum outlines acceptable renewable sources to include: * agency-funded renewable energy on-site with renewable energy certificate retained; * on-site or off-site renewable energy developed by contract, with renewable energy certificates retained for the contract's life; * purchasing electricity and corresponding renewable energy certificates; * purchasing renewable energy certificates.	◑	**Summary:** LEED v4 NC aligns with, but does not meet all of the Federal Requirements for on-Site Renewable Energy & Green Power. LEED v4 NC Renewable Energy Production (EA Credit 5) awards credit to projects that produce between 1%-10% of their energy requirement on-site. Renewable energy production is typically on-site, although LEED v4 NC allows for off-site owned or leased systems to be awarded credit if RECs are also acquired. These configurations of energy production, use, and REC retainment support the agency-wide Federal Requirements for points (i) and (ii). Similarly, the agency-wide Federal Requirements for points (iii) and (iv) address green power and both points are supported by Green Power and Carbon Offsets (EA Credit 7) for Green Power and Carbon Offsets. LEED v4 NC requires all Green Power and Carbon Offsets to be Green-e certified. The Federal Requirements have no such qualifications. Because LEED v4 NC Renewable Energy Production (EA Credit 5) permits a range of applicable types of renewable energy including solar pv, tidal, wind, and geothermal, LEED v4 NC is related to but not directly aligned with the Federal Requirement for solar hot water. **Renewable Energy Production (EA Credit 5) (3 pts.)** Credit is awarded for the installation of 1%-10% of renewable energy on-site. Allowable sources of renewable energy include photovoltaic, solar thermal, wind, biofuel (in some cases), low-impact hydroelectricity, wave and tidal energy, and geothermal energy (in some cases). **Green Power and Carbon Offsets (EA Credit 7) (2 pts.)** Qualifying renewable energy credits or carbon offsets may be purchased for 50%-100% of project energy for 5 years to earn points. All RECs must have originated after January 1, 2005.
What is the baseline or point of comparison?	100% of energy from renewable energy certificates must be produced by sources of renewable energy placed into service within 10 years prior to the start of the		Annual energy cost
What is the range of requirements to achieve the metric?	N/A		**EAc5:** 1%-10% (1-3 pts.) **EAc7:** 50%-100% (1-2 pts.)
What standards or tools are required for the metric?	N/A		Center for Resource Solutions Green-e Program, Commercial Building Energy Consumption Survey (CBECS)
Is on-site generation and purchases of green power treated differently?	No		Yes. Renewable energy production is typically on-site although LEED v4 NC EA Credit 5 allows for off-site owned or leased systems to be awarded credit if RECs are also acquired. LEED v4 NC Credit 7 addresses green power and carbon offsets specifically.
Measurement and Verification			

Energy			
Review Questions	**Federal Requirements (NC)**		**LEED v4 BD+C: New Construction (2014 Update)**
Does the metric help a building meet a current Federal Requirement?	Per the Energy Policy Act of 2005 (EPAct) Section 103, install building level electricity meters in new major construction and renovation projects to track and continuously optimize performance. Per EISA Section 434, include equivalent meters for natural gas and steam, where natural gas and steam are used. The Presidential Memo on Energy Management (2013) requires agencies to install (where cost-effective and appropriate) building energy meters, energy sub-meters and water meters, and to enter metered data into the EPA ENERGY STAR Portfolio Management System to support benchmarking. Annual energy performance data will continue to be publicly disclosed through DOE's web-based tracking system.	◑	**Summary:** LEED v4 NC EA Prerequisite 3 meets the Federal Requirement for building level electricity, natural gas and steam meters, as well as tracking data. Building-Level Water Metering (WE Prerequisite 3) meets the Federal Requirement for building-level water meters. In addition, LEED v4 NC Water Metering (WE Credit 4) and Advanced Energy Metering (EA Credit 3) both support the installation of sub-meters for related systems. LEED v4 NC does not require reporting energy and water data in the EPA's ENERGY STAR Portfolio Manager, but does require projects to report energy and water data to the USGBC for data aggregation and analysis, creating a duplicative reporting requirement. USGBC will accept data from approved sources. **Building-Level Water Metering (WE Prerequisite 3)** Building-level water metering for water use in the building as well as associated grounds is required for WE prerequisite 3. Projects are required to share water data with the USGBC over a 5 year period. **Water Metering (WE Credit 4) (1 pt.)** Water metering further encouraged with a credit for sub-metering at least two systems including options for irrigation, indoor plumbing, domestic hot water, large boilers, reclaimed water, or other process water. **Building-Level Energy Metering (EA Prerequisite 3)** The prerequisite requires that building-level energy meters are installed (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc.), or sub-meters that have the ability to aggregate data for whole building reporting. All data needs to be shared with the USGBC for a period of 5 years. The USGBC works to reduce disparities between predictive and actual performance by analyzing data and sharing results. **Advanced Energy Metering (EA Credit 3) (1 pt.)** To earn credit, the project must also install meters to energy end uses that represent 10% or more of the total building energy consumption. The data collection system for the advanced metering must use a local area network, building automation system, wireless network, or comparable communication infrastructure.
What is the baseline or point of comparison?	N/A		**WEp3:** N/A **WEc4**: N/A **EAp3:** N/A **EAc3:** N/A
What is the range of requirements to achieve the metric?	N/A		**WEp3:** Compliance **WEc4**: Compliance (1 pt.) **EAp3:** Compliance **EAc3:** Compliance (1 pt.)
What standards or tools are required for the metric?	EPAct 2005 Section 103; EISA Section 434		N/A
Benchmarking			

Energy

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Compare actual performance data from the first year of operation with the energy design target, preferably by using ENERGY STAR Portfolio Manager for building and space types covered by ENERGY STAR. Verify that the building performance meets or exceeds the design target, or that actual energy use is within 10% of the design energy budget for all other building types. For other building and space types, use an equivalent benchmarking tool such as the Labs21 benchmarking tool for laboratory buildings.	◑	**Summary:** Both the Federal Requirements and LEED v4 NC require projects to document post-occupancy energy use, but they use different methodologies for benchmarking actual performance. LEED v4 NC relies on the USGBC to analyze data is opposed to the use of ENERGY STAR Portfolio Manager preferred by the Federal Requirements. LEED v4 NC does not require that specific energy reduction goals be set as part of the design process that requires documentation as a requirement of a LEED v4 NC prerequisite or credit. There is no requirement for the actual energy use to be within 10% of the predicted value. Because of these differences, LEED v4 NC relates to, but does not meet each of the Federal Requirements for benchmarking. **Building-Level Energy Metering (EA Prerequisite 3)** The prerequisite requires that building-level energy meters are installed, or sub-meters that have the ability to aggregate data for whole building reporting. All data needs to be shared with the USGBC for a period of 5 years. The USGBC works to reduce disparities between predictive and actual performance by analyzing data and sharing results.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		**EAp3:** Compliance
What standards or tools are required for the metric?	ENERGY STAR		N/A

Water

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Indoor Water			
Does the metric help a building meet a current Federal Requirement?	Employ strategies that in aggregate use a minimum of 20% less potable water than the indoor water use baseline calculated for the building, after meeting the EPAct 1992, Uniform Plumbing Codes 2006, and the International Plumbing Codes 2006 fixture performance requirements. The installation of water meters is encouraged to allow for the management of water use during occupancy. The use of harvested rainwater, treated wastewater, and air conditioner condensate should also be considered and used where feasible for non-potable use and potable use where allowed.	●	**Summary:** LEED v4 NC meets the Federal Requirements for 20% water reductions through fixture efficiency in Indoor Water Use Reduction (WE Prerequisite 2). Projects are required to report water data to USGBC, however, creating a duplicative reporting system for Federal projects. Reductions greater than 20% (using fixture efficiency or alternative water technologies) will be awarded credit as part of Indoor Water Use Reduction (WE Credit 2), as are the use of non-potable / alternative sources of water and water reuse. In addition, LEED v4 NC requires the installation of building level water metering in Building-Level Water Metering (WE Prerequisite 3) (also part of the Federal Requirement), and encourages submetering of major water uses through Water Metering (WE Credit 4). **Indoor Water Use Reduction (WE Prerequisite 2) (20%)** The prerequisite requires that the project meet and exceed EPAct 1992 and 2005, as well as UPC/IPC 2006, by 20%. The 20% reduction must be achieved through fixture and fitting efficiency as opposed to alternative (non-potable) water sources. The prerequisite also requires adherence to prescriptive water efficiency requirements for appliances and process water use including clothes washers, ice machines, cooling towers and evaporative condensers. In addition, WaterSense label requirements are mandatory where applicable indicating an alignment with and support of Federal Programs. **Building-Level Water Metering (WE Prerequisite 3)** Building-level water metering for water use in the building and associated grounds is required for WE prerequisite 3. Projects are required to share water data with the USGBC over a 5 year period. **Indoor Water Use Reduction (WE Credit 2) (25%-50%) (1-6 pts.)** Credit 2 provides additional credit for indoor water fixture reductions from 25-50% and provides additionally stringent requirements for appliance and process water use reductions. Once 20% water reductions are achieved through efficiency as part of the prerequisite, additional reductions may be achieved through fixture efficiency or through the use of alternative water sources (e.g. water harvesting for reuse). **Water Metering (WE Credit 4) (1 pt.)** Water metering is further encouraged with a credit for submetering at least two systems including irrigation, indoor plumbing, domestic hot water, large boilers, reclaimed water, or other process water.
What is the baseline or point of comparison?	EPAct 1992 and 2005, UPC/IPC 2006		**WEp2:** EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements **WEp3:** N/A **WEc2:** EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements **WEc4:** N/A
What is the range of requirements to achieve the metric?	20%		**WEp2:** 20% **WEp3:** Compliance **WEc2:** 25%, 30%, 35%, 40%, 45%, 50% (1-6 pts.) **WEc4:** Prescriptive
What standards or tools are required for the metric?	EPAct 1992 and 2005, UPC/IPC 2006		Water Use Calculator provided by USGBC

Water

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Process Water			
Does the metric help a building meet a current Federal Requirement?	Per the Energy Policy Act of 2005 Section 109, when potable water is used to improve a building's energy efficiency, deploy lifecycle cost effective water conservation measures.	●	**Summary:** Although the Federal Requirements do not specify which process water uses are to be addressed, LEED v4 NC meets the Federal Requirements by including prescriptive efficiency requirements for the majority of process water uses in most building types covered by LEED v4 NC, including cooling tower water, appliances, etc. Additional credit is awarded for additional cooling tower-specific water efficiency in Cooling Tower Water Use (WE Credit 3). If a building has an atypical process water use profile, it is possible that the LEED v4 Indoor Water Use Reduction (WE Prerequisite 2) may not address certain process water uses, such as industrial water use. **Indoor Water Use Reduction (WE Prerequisite 2)** WEp2 includes prescriptive requirements for appliance and select process water uses. To meet the prerequisite, project teams must comply with the prescriptive levels of efficiency for all applicable appliances and process water uses. Example measures include: no once-through cooling water, makeup water meters, conductivity controllers, overflow alarms, and drift eliminators. **Cooling Tower Water Use (WE Credit 3) (1-2 pts.)** LEED v4 has included a credit to reduce the amount of water used for cooling tower makeup and maintenance.
What is the baseline or point of comparison?	N/A		**WEp2:** EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements **WEc3:** N/A
What is the range of requirements to achieve the metric?	N/A		**WEp2:** 20% **WEc3:** Establishes maximum concentrations for parameters in condenser water and the number of cooling tower cycles.(1-2 pts.)
What standards or tools are required for the metric?	N/A		Water Use Calculator provided by USGBC
Outdoor Water			

Water

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Use water efficient landscape and irrigation strategies, such as water reuse, recycling, and the use of harvested rainwater, to reduce outdoor potable water consumption by a minimum of 50% over that consumed by conventional means (plant species and plant densities). The installation of water meters for locations with significant outdoor water use is encouraged.	◕	**Summary**: If the LEED v4 NC Outdoor Water Use Reduction (WE Prerequisite 1) is met, the project will achieve a 30% reduction relative to the EPA WaterSense Water Budget Tool, as opposed to the Federal Requirement of 50% below that which would be "consumed by conventional means." Differences between these baseline stringencies have not been reviewed for this report. If Outdoor Water Use Reduction (WE Credit 1) is achieved, and assuming the baselines of water "consumed by conventional means" and the EPA WaterSense Water Budget Tool are roughly equivalent, then projects will meet the Federal Requirements as a 50% potable water reduction would be achieved. In addition, metering of total water for a building and associated grounds is included in Building-Level Water Metering (WE Prerequisite 3), and sub-metering for outdoor water use is awarded credit as part of Water Metering (WE Credit 4) (submetering), supporting the Federal Requirements recommendation to meter significant use of outdoor water. Total versus potable water. LEED v4 NC requires, as part of the prerequisite, that the first 30% reduction is achieved through water reduction only (rather than using non-potable sources to displace potable water). Additional reductions of potable water can be achieved using non-potable sources and are awarded credit for doing so as part of Outdoor Water Use Reduction (WE Credit 1). **Outdoor Water Use Reduction (WE Prerequisite 1)** WEp1 requires that projects reduce total water used for irrigation by 30% through efficiency measures and plant selection. Non-potable water sources can not contribute to this requirement. **Building-Level Water Metering (WE Prerequisite 3)** Building-level water metering for water use in the building as well as associated grounds is required for WEp3. Projects are required to share water data with the USGBC over a 5 year period. **Outdoor Water Use Reduction (WE Credit 1) (1-2 pts.)** WEc1 awards credit for 50%-100% reductions in potable water through efficiency or the use of non-potable water sources. **Water Metering (WE Credit 4) (1 pt.)** Outdoor water sub-metering is encouraged through WEc4, which requires sub-metering of at least two systems including irrigation, indoor plumbing, domestic hot water, large boilers, reclaimed water, or other process water.
What is the baseline or point of comparison?	water use by conventional means		**WEp1/WEc1:** Peak watering month **WEp3/WEc4:** N/A
What is the range of requirements to achieve the metric?	50%		**WEp1:** 30% **WEp3:** Compliance **WEc1:** 50% (1 pt.), 100% (2 pts.) **WEc4:** Prescriptive (1 pt.)
What standards or tools are required for the metric?	N/A		WaterSense Water Budget Tool
Stormwater			

Water

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Employ design and construction strategies that reduce stormwater runoff and discharge polluted water offsite. Per EISA Section 438, to the maximum extent technically feasible, maintain or restore the predevelopment hydrology of the site with regard to temperature, rate, volume, and duration of flow using site planning, design, construction, and maintenance strategies.	◕	**Summary:** If the LEED v4 NC Rainwater Management (SS Credit 4) is achieved, then the project will meet the Federal Requirements. While LEED v4 does not require restoring sites to predevelopment hydrology conditions, it does set stringent targets (i.e. managing 95th or 98th percentile rain events on site) that are likely in line with or exceed the Federal Requirements of " to the maximum extent technically feasible, maintain or restore the predevelopment hydrology of the site." Further, while the credit requirements do not specifically address the temperature of stormwater, it is assumed that temperature is regulated through the implementation of low-impact development (LID) and green infrastructure. Meeting the rainwater requirements in LEED v4 NC requires consideration of natural site hydrology and strategies to best mimic it. **Rainwater Management (SS Credit 4) (2-3 pts.)** The LEED v4 NC credit combines what used to be split into two credits for quantity and quality. The credit focuses on a more holistic site water management that relies on green infrastructure and low-impact development strategies to reduce runoff (and thus improve quality).
What is the baseline or point of comparison?	N/A		Regional or local rainfall event volume Predevelopment annual discharge quantity
What is the range of requirements to achieve the metric?	N/A		95 percentile of regional or local rainfall events (2 pts.) 98 percentile of regional or local rainfall events (3 pts.) 85 percentile of regional or local rainfall events - for zero lot-line project only (3 pts.) No additional runoff volume for post-development condition (3 pts.)
What standards or tools are required for the metric?	EISA Section 438		U.S. EPA Technical Guidance on Implementing the Rainwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act
Water-Efficient Products			

Water

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Specify EPA's WaterSense-labeled products or other water conserving products, where available. Choose irrigation contractors who are certified through a WaterSense labeled program.	◑	**Summary:** LEED v4 NC is related to but not directly aligned with the Federal Requirements. While Outdoor Water Use Reduction (WE Prerequisite 1)/ Outdoor Water Use Reduction (WE Credit 1) use the WaterSense Water Budget Tool for irrigation efficiency calculations and Indoor Water Use Reduction (WE Prerequisite 2) requires the specification of WaterSense labeled fixtures, LEED v4 NC does not specifically require the use of irrigation contractors who are certified through a WaterSense labeled program. **Outdoor Water Use Reduction (WE Prerequisite 1)** WEp1 requires the WaterSense Water Budget Tool be used for irrigation efficiency calculations, although it does not require the use of a certified irrigation contractor. **Indoor Water Use Reduction (WE Prerequisite 2)** WEp2 requires that "all newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled." **Outdoor Water Use Reduction (WE Credit 1) (1-2 pts.)** WEc1 requires the WaterSense Water Budget Tool be used for irrigation efficiency calculations, although it does not require the use of a certified irrigation contractor.
What is the baseline or point of comparison?	N/A		**WEp1/WEc1:** Peak watering month **WEp2:** EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements
What is the range of requirements to achieve the metric?	N/A		**WEp1:** 30% **WEp2:** 20% **WEc1:** 50% (1 pt.), 100% (2 pts.)
What standards or tools are required for the metric?	EPA WaterSense		WaterSense Water Budget Tool, Water Use Calculator provided by USGBC

Indoor Environment

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Ventilation			
Does the metric help a building meet a current Federal Requirement?	Meet ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone, and ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality.	●	**Summary:** LEED v4 NC Minimum Indoor Air Quality Performance (EQ Prerequisite 1) meets the Federal Requirements for ventilation (providing adequate fresh air for occupants), as required by ASHRAE Standard 62.1-2007. LEED v4 NC Fundamental Commissioning and Verification (EA Prerequisite 1) references the updated and more stringent version of the standard; ASHRAE 62.1-2010. The Federal Requirement for thermal comfort (control for temperature, humidity, air speed, radiant heating and cooling) is addressed by a separate LEED v4 NC credit and the ASHRAE Standard 55-2004, and is discussed in the next section. The full circle rating is for ventilation only. **Minimum Indoor Air Quality Performance (EQ Prerequisite 1)** Meet the minimum requirements of ASHRAE 62.1-2010, Sections 4-7, Ventilation for Acceptable Indoor Air Quality, or a local equivalent, whichever is more stringent. In addition, the prerequisite in v4 requires air quality monitoring, further strengthening minimum air quality requirements in every LEED v4 NC project. **Enhanced Indoor Air Quality Strategies (EQ Credit 1) (1-2 pts.)** This credit enhances the minimum indoor air quality aspects of the prerequisite by including requirements for walk-off mats for entryway systems, interior cross-contamination prevention, CO2 monitoring, and filtration. A 30% increase in fresh air relative to ASHRAE 62.1-2010 is required to earn credit.
What is the baseline or point of comparison?	N/A		**EQp1:** ASHRAE 62.1-2010 (establishes minimum fresh air volumes per the ventilation rate procedure) **EQc1:** ASHRAE 62.1-2010 (establishes minimum fresh air volumes per the ventilation rate procedure)
What is the range of requirements to achieve the metric?	N/A		**EQp1:** Compliance **EQc1:** 30% more fresh air than is required per ASHRAE 62.1-2010 (1-2 pts.)
What standards or tools are required for the metric?	ASHRAE Standard 62.1-2007 and portions of ASHRAE Standard 55-2004, Thermal Environmental		ASHRAE 62.1-2010, or local equivalent, CIBSE Applications Manual AM10, March 2005
Thermal Comfort			
Does the metric help a building meet a current Federal Requirement?	Meet ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone, and ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality.	◕	**Summary:** Achieving LEED v4 NC Thermal Comfort (EQ Credit 5) meets the Federal Requirements for thermal comfort as required by ASHRAE 55-2004. LEED v4 NC EAc5 references the updated and more stringent version of the standard; ASHRAE 55-2010. The Federal Requirement for ventilation is addressed by ASHRAE Standard 62.1-2004 and is discussed in the previous section. The 3/4 circle rating is for thermal comfort only. **Thermal Comfort (EQ Credit 5) (1 pt.)** To achieve the credit, projects must be designed to ASHRAE 55-2010 Standard. In addition, LEED v4 NC has combined requirements for controllability of systems with this credit to enhance occupant comfort and well-being. In addition, individual thermal comfort controls need to be provided to at least 50% of individual occupants and also in multioccupant spaces.

Indoor Environment

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
What is the baseline or point of comparison?	N/A		55.1-2010: N/A
What is the range of requirements to achieve the metric?	N/A		**EQc5:** Option 1: Compliance (1 pt.) Option 2: Controls for 50% of occupants (1 pt.)
What standards or tools are required for the metric?	ASHRAE Standard 55-2004 and ASHRAE Standard 62.1-2007		ASHRAE 55-2010, ISO 7730-2005 Ergonomics of the thermal environment, analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, European Standard EN 15251:2007, indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, Section A2.
Daylighting			
Does the metric help a building meet a current Federal Requirement?	Achieve a minimum daylight factor of 2% in 75% of all space occupied for critical visual tasks.	◕	**Summary:** Achieving the LEED v4 NC Daylight (EQ Credit 7) and earning sufficient points would meet the Federal Requirements. Although LEED v4 NC uses a different metric and calculation methodology than the Federal Requirements, LEED v4 NC's metric of 300 lux is likely greater than a daylight factor of 2% (the latter depends on outdoor conditions, although even at full daylight, outdoor light levels are ~10,000 lux, which would make a 2% daylight factor = 200 lux, less than the 300 specified by LEEDv4 NC). However, LEED v4 NC allows for a lower percentage of the building's regularly occupied areas to be daylit (55% of regularly occupied areas) to earn 2 points, while the federal government calls for 75% of all space occupied for critical visual tasks. Although, it may be that 75% of all space occupied for critical visual tasks is actually less than 55% of all regularly occupied areas, depending on the use, the difference in methodology is sufficient to require that a project team earn the number of points associated with 75% of regularly occupied daylit areas to meet the Federal Requirement. **Daylight (EQ Credit 7)** Option 1: Provide a daylight simulation with a Spatial Daylight Autonomy (sDA) 300/50% for 55-90% of regularly occupied floor area (2-3 pts.) Option 2: Computer modeling to demonstrate 300-3,000 lux for 9am and 3pm for 55%-75% of regularly occupied space; without furniture. (1-2 pts.) Option 3: Computer modeling to demonstrate 300-3,000 lux for 9am and 3pm for 55%-75% of regularly occupied space; with furniture. (2-3 pts.) Note: 1 lux = 0.0929 foot candle
What is the baseline or point of comparison?	All space occupied for critical visual tasks		Regularly occupied floor area
What is the range of requirements to achieve the metric?	75%		55%-90% (1-3 pts.)
What standards or tools are required for the metric?	N/A		Daylight and quality views calculator provided by USGBC
Environmental Tobacco Smoke Control			

Indoor Environment

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Implement a policy and post signage indicating that smoking is prohibited within the building and within 25 feet of all building entrances, operable windows, and building ventilation	●	**Summary:** LEED v4 NC meets the Federal Requirement. **Environmental Tobacco Smoke Control (EQ Prerequisite 2)** Smoking is prohibited in the building and within 25 feet of entrances, outdoor air intakes, and operable windows.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		N/A
What standards or tools are required for the metric?	N/A		N/A
Moisture Control			
Does the metric help a building meet a current Federal Requirement?	Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks related to moisture.	◑	**Summary:** LEED v4 NC is related to but not directly aligned with the Federal Requirements. Enhanced Commissioning (EA Credit 1) Envelope Commissioning (Option 2) addresses elements of moisture control through envelope commissioning. This process helps project teams catch and correct moisture control issues associated with the building envelope but does not address all possible sources of condensation such as space conditioning, refrigeration, and food service equipment, ductwork, and rooftop HVAC equipment. Further, LEED v4 NC does not require design teams to explicitly plan for potential moisture control issues, and therefore does not meet the Federal Requirements. Construction Indoor Air Quality Management Plan (EQ Credit 3) addresses elements of moisture control through the protection of building materials during construction. Thermal Comfort (EQ Credit 5) addresses moisture as an indicator of comfort. Input from occupant comfort surveys may inform building operators about moisture problems and appropriate humidity level, but does not specifically address maintenance/operations. **Enhanced Commissioning (EA Credit 1)** Option 2: Envelope Commissioning (2 pts.) The credit requirement includes the review of contractor submittals, verification of installed systems, training, verification of seasonal testing, post-occupancy review of operations and on-going commissioning for the envelope. **Construction Indoor Air Quality Management Plan (EQ Credit 3) (1 pt.)** Requires projects to meet or exceed all applicable recommended control measures of the SMACNA IAQ Guidelines, including the protection of absorptive materials stored on-site and installed from moisture damage. **Thermal Comfort (EQ Credit 5) (1 pt.)** To achieve the credit, projects must be designed to ASHRAE 55-2010 Standard. In addition, LEED v4 NC has combined requirements for controllability of systems with this credit to enhance occupant comfort and well-being. In addition, individual thermal comfort controls need to be provided to at least 50% of individual occupants and also in multioccupant spaces. This credit addresses moisture in the context of occupant comfort and does not address installed materials or ongoing maintenance/operations strategies for moisture control.

Indoor Environment

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
What is the baseline or point of comparison?	N/A		**EAc1:** Compliance **EQc3:** Compliance **EQc5:** 55.1-2010: N/A
What is the range of requirements to achieve the metric?	N/A		**EAc1:** Option 2: Compliance (2 pts.) **EQc3:** Compliance (2 pt.) **EQc5:** The entire building should be designed to ASHRAE 55.1-2010 and provide occupants controls (1 pt.)
What standards or tools are required for the metric?	N/A		ASHRAE Guideline 0-2005, ASHRAE Guideline 1.1-2007, National Institute of Building Sciences (NIBS) Guideline 3-2012, Exterior Enclosure Technical Requirements for the Commissioning Process, Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3), ASHRAE 55-2010, ISO 7730-2005 Ergonomics of the thermal environment, analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, European Standard EN 15251:2007, indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, Section A2.

Protect Indoor Air Quality During Construction

Indoor Environment

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 2007. After construction and prior to occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60%. After occupancy, continue flush-out as necessary to minimize exposure to contaminants from new building materials.	◕	**Summary:** Earning LEED v4 NC Construction indoor Air Quality Management Plan (EQ Credit 3) and Indoor Air Quality Assessment (EQ Credit 4) will meet the Federal Requirements. LEED v4 NC Construction indoor Air Quality Management Plan (EQ Credit 3) requires best practices on site during construction and meets the requirements in SMACNA, and Indoor Air Quality Assessment (EQ Credit 4) requires a volumetric air change protocol to meet credit requirements. Although the Federal Requirements are based on duration of flush out, the amount of time required to exchange the prescribed volume of air in the LEED v4 NC requirements would almost certainly exceed the 72 hours called for by the Federal Requirements. LEED v4 NC also allows projects to conduct air quality testing as an alternative to the building flush out. Air quality testing is not recognized in the Federal Requirements. **Construction indoor Air Quality Management Plan (EQ Credit 3) (1 pt.)** Requires plans to be developed and implemented to protect IAQ during construction and requires SMACNA, 2nd edition, 2007, ANSI/SMACNA 008-2008, Chapter 3 standards be met. **Indoor Air Quality Assessment (EQ Credit 4) (1-2 pts.)** Option 1: Path 1: (1 pt.) Prior to occupancy - requires a building flush out of 14,000 cubic feet of outdoor air per square foot of gross floor area while maintaining a temperature between 60-80 degrees F and humidity no greater than 80% Path 2:(1 pt.) During occupancy - requires a building flush out of 3,500 cubic feet of outdoor air per square foot of gross floor area while maintaining a temperature between 60-80 degrees F and humidity no greater than 80%. This conditions must be maintained until 14,000 cubic feet of outdoor air per square foot has been delivered to the space. Option 2: Air testing (2 pts.)
What is the baseline or point of comparison?	72 hours		**EQc3:** N/A **EQc4:** Option 1: 14,000 cubic feet of outdoor air per square foot of or air has been delivered to the space Option 2: air quality testing
What is the range of requirements to achieve the metric?	N/A		**EQc3:** Compliance (1 pt.) **EQc4:** Option 1: Compliance (1 pt.) Option 2: Compliance (2 pts.)
What standards or tools are required for the metric?	N/A		Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3)

Acoustics (Not in GP)

Indoor Environment

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies acoustics as an element of indoor environmental quality to be considered during the certification system review.	◕	**Summary:** If the LEED v4 NC Acoustics Performance (EQ Credit 9) is achieved, the project will meet the Federal Requirement of promoting improved indoor environmental quality through acoustics. **Acoustics Performance (EQ Credit 9) (1 pt.)** Option 1: (1 pt.) Requires that all occupied spaces meet stated requirements, as applicable, for HVAC background noise, sound isolation, reverberation time, and sound reinforcement and masking systems. Option 2: (1 pt.) Requires that projects meet stated requirements for acoustical finishes and site exterior noise.
What is the baseline or point of comparison?	N/A		Option 1: Specific requirements for each parameter. Option 2: N/A
What is the range of requirements to achieve the metric?	N/A		Option 1: Compliance (1 pt.) Option 2: Compliance (1 pt.)
What standards or tools are required for the metric?	N/A		ASHRAE 2011, HVAC Applications Handbook, Chapter 48, Noise and Vibration Control, or local equivalent
Low Emitting Materials			
Does the metric help a building meet a current Federal Requirement?	Low-Emitting Materials. Specify materials and products with low pollutant emissions, including composite wood products, adhesives, sealants, interior paints and finishes, carpet systems, and furnishings.	◕	**Summary:** If the project achieves LEED v4 NC Low-Emitting Materials (EQ Credit 2), it will meet Federal Requirements. The products covered by LEED v4 NC categories align with the Federal Requirements. Compliance with Low-Emitting Materials (EQ Credit 2) may also be met through a budget calculation method. **Low-Emitting Materials (EQ Credit 2) (1-3 pts.)** Compliance with the credit is met by meeting set requirements per material category or through a budget calculation method. Option 1: Product Category Calculations (1-3 pts.) Compliance with the credit is met by meeting set requirements per material category. Option 2: Budget Calculation Method (1-3 pts.) Compliance of 50%, 70% or 90% of products Categories: Interior paints and coatings, interior adhesives and sealants, flooring, composite wood, ceilings/walls/thermal/acoustics insulation, and furniture.
What is the baseline or point of comparison?	N/A		Option 1: Requirements for each of the six categories Option 2: Percentage of compliant materials
What is the range of requirements to achieve the metric?	N/A		Option 1: Compliance with 3-6 out of 6 product categories (1-3 pts.) Option 2: 50%, 70%, 0r 90% of products (1-3 pts.)
What standards or tools are required for the metric?	N/A		N/A

Materials			
Review Questions	**Federal Requirements (NC)**		**LEED v4 BD+C: New Construction (2014 Update)**
Recycled Content			
Does the metric help a building meet a current Federal Requirement?	Per Section 6002 of the Resource Conservation and Recovery Act (RCRA), for EPA-designated products, specify products meeting or exceeding EPA's recycled content recommendations. For other products, specify materials with recycled content when practicable. If EPA-designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building. EPA's recycled content product designations and recycled content recommendations are available on EPA's Comprehensive Procurement Guideline web site at <www.epa.gov/cpg>.	◑	**Summary:** LEED v4 NC does not require the specification or use of EPA-designated products, although credit is awarded for a variety of recycled content materials. The Federal Requirements rely on the EPA's guideline which is specific to specifying recycled content in a variety of construction materials. MR Credit 3 may be achieved without the specification of any recycled content materials. Because of this, LEED v4 NC is related to but not directly aligned with the Federal Requirements. If EPA-designated products with recycled content are chosen to attain the credit, the Federal Requirement could be met. **Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 3) (Option 2) (1 pt.)** LEED v4 combines several environmentally preferable attributes into a single credit for sourcing of raw materials that covers extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content. To achieve the credit, projects must specify products that meet one or more of the above criteria for 25% of project materials by cost. There is no guarantee that recycled content materials will be chosen.
What is the baseline or point of comparison?	N/A		Option 2: Total cost of materials on the project
What is the range of requirements to achieve the metric?	N/A		25% project cost threshold for credit achievement (1 pt.)
What standards or tools are required for the metric?	EPA's Comprehensive Procurement Guideline		ISO 14021-1999, Environmental Labels and Declarations, Self-Declared Environmental Claims (Type II Environmental Labeling)
Biobased Content			

Materials			
Review Questions	**Federal Requirements (NC)**		**LEED v4 BD+C: New Construction (2014 Update)**
Does the metric help a building meet a current Federal Requirement?	Per Section 9002 of the Farm Security and Rural Investment Act (FSRIA), for USDA-designated products, specify products with the highest content level per USDA's bio-based content recommendations. For other products, specify bio-based products made from rapidly renewable resources and certified sustainable wood products. If these designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building. USDA's biobased product designations and bio-based content recommendations are available on USDA's BioPreferred web site at <www.usda.gov/biopreferred>.	◑	**Summary:** LEED v4 NC is related to but not directly aligned with the Federal Requirements. The Federal Requirements rely on the USDA's guideline which is specific to specifying bio-based content in a variety of construction materials. If USDA-designated products are chosen as bio-based materials to attain the credit, the Federal Requirement could be met. LEED v4 NC MR Credit 3 does not require the specification or use of USDA-designated products, although credit is awarded for a variety of bio-based products. The credit requires that bio-based materials meet the Sustainable Agriculture Standard to receive credit and that certified wood comply with the Forest Stewardship Council standard. **Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 3) (Option 2) (1 pt.)** LEED v4 combines several environmentally preferable attributes into a single credit for sourcing of raw materials that covers extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content. To achieve the credit, projects must specify products that meet one of the above criteria for 25% of project materials by cost.
What is the baseline or point of comparison?	N/A		Option 2: Total cost of materials on the project (1 pt.)
What is the range of requirements to achieve the metric?	N/A		25% project cost threshold for credit achievement.
What standards or tools are required for the metric?	USDA's Bio Preferred website		Wood: Forest Stewardship Council Bio-based Materials (non-wood): ASTM D6866, Sustainable Agriculture Standard of the Sustainable Agricultural Network
Environmentally Preferable Products			

Materials

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Use products that have a lesser or reduced effect on human health and the environment over their lifecycle when compared with competing products or services that serve the same purpose. A number of standards and ecolabels are available in the marketplace to assist specifiers in making environmentally preferable decisions. For recommendations, consult the Federal Green Construction Guide for Specifies at <www.wbdg.org/design/greenspec.php>.		**Summary:** If LEED v4 NC MR Credit 1 and MR Credit 2 are achieved, then the project will meet the Federal Requirements. While MRc2 addresses lifecycle impact reductions as specified in the Federal Requirements, MRc3 provides an opportunity for a project to meet the Federal Requirement for eco-labels. MR Credit 4 addressed environmental attributes such as biobased materials, recycled content and regional materials, all of which are thought to reduce the environmental impact of materials and are considered elements of environmentally preferable products. In addition, the achievement of MR Credit 5 contains specific actions around ingredient inventories that may lead to improved human health outcomes. While such transparency is not specifically addressed in the Federal Requirements, it will support the goal of reducing the effect of building products on human health. **Building Life-Cycle Impact Reduction (MR Credit 1)(Option 4) (3 pts.)** Credit is awarded to projects that conduct a life-cycle assessment of the project's structure and enclosure that demonstrates a minimum of 10% reduction, compared with a baseline building, in at least three of the six listed impact categories: global warming potential, depletion of the stratospheric ozone layer, acidification of land and water resources, eutrophication, formation of tropospheric ozone, depletion of nonrenewable energy sources. **Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 2) (1-2 pts.)** Option 1: Credit can be achieved in Option 1 for Environmental Product Declarations with the permanent installation of at least 20 different products sourced from at least five different manufacturers that meet one of the disclosure criteria summarized below: (i) Product-specific declarations (ISO 14044) (ii) Environmental product declarations (ISO 14025, 14040, 14044, and EN 15804 or ISO 21930) Option 2: Credit can also be achieved with Option 2 for multi-attribute optimization of 50% of materials by cost for products that reduce their impact below industry averages in at least three of the following categories: global warming potential; depletion of the stratospheric ozone layer; acidification of land and water resources; eutrophication; formation of tropospheric ozone; depletion of nonrenewable energy sources **Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 3)(Option 2) (1 pt.)** LEED v4 combines several environmentally preferable attributes into a single credit for sourcing of raw materials that covers extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content. To achieve the credit, projects must specify products that meet one of the above criteria for 25% of project materials by cost. **Building Product Disclosure and Optimization - Material Ingredients (MR Credit 4)(1-2 pts.)** Option 1: Use 20 products that inventory chemicals to at least 0.1% based on approved inventory programs (1 pt.) Option 2: Use products that optimize ingredients based on approved programs for 25% of project building product costs (1 pt.) Option 3: Use products with supply chain optimization as described by LEED v4 NC for 25% of project building product costs (1 pt.)

Materials

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
What is the baseline or point of comparison?	N/A		**MRc1:** Option 4: Baseline building (3 pts.) **MRc2:** Option 1: N/A (1 pt.) Option 2: Total cost of materials on the project. (1 pt.) **MRc3:** Option 2: Total cost of materials on the project (1 pt.) **MRc4:** Option 1: Number of products (1 pt.) Option 2: Total cost of materials on the project (1 pt.) Option 3: Total cost of materials on the project (1 pt.)
What is the range of requirements to achieve the metric?	N/A		**MRc1:** Option 4: 10% reduction in three of the six categories **MRc2:** Option 1: 20 products Option 2: 50% of the total cost of materials on the project must comply with Option 2. To comply, each product that meets three of the listed criteria may contribute 100% of its cost to the calculation. **MRc3:** Option 2: 25% project cost threshold for credit achievement. **MRc4:** Option 1: number of products Option 2: 25% project cost threshold Option 3: 25% project cost threshold
What standards or tools are required for the metric?	N/A		recycled content section biobased content Environmentally preferable products waste and materials management
Waste and Materials Management			

Materials

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Incorporate adequate space, equipment, and transport accommodations for recycling in the building design. During a project's planning stage, identify local recycling and salvage operations that could process site-related construction and demolition materials. During construction, recycle or salvage at least 50% of the non-hazardous construction, demolition and land clearing materials, excluding soil, where markets or on-site recycling opportunities exist. Provide salvage, reuse and recycling services for waste generated from major renovations, where markets or on-site recycling opportunities exist.	◕	**Summary:** If the LEED v4 NC MR Credit 9 is achieved, then the project will meet the Federal Requirements for diverting construction waste from the landfill through recycling, salvage and reuse. MR Prerequisite 1 meets the requirement for the collection of recyclables during operations. In addition, although not a requirement of the Federal Requirements, MR Credit 1 provides credit to projects that incorporate salvaged and reused materials into the project. **Storage and Collection of Recyclables (MR Prerequisite 1)** Requires dedicated areas that are accessible to waste haulers and building occupants for the collection and storage of recyclables for use post-occupancy. In addition to the range of recyclable materials required for collection in LEED 2009, including paper, cardboard, glass, plastic and metals, LEED v4 also requires the collection and recycling of two of the following three waste types: batteries, mercury-containing lamps, and e-waste. **Construction and Demolition Waste Management Planning (MR Prerequisite 2)** Develop and implement a construction and demolition waste management plan that establishes waste diversion goals for the project in at least five material categories, as well as logistical considerations and recycling facility information. The requirement of a management plan is intended to assure that the waste diversion process will be optimized for each project. **Construction and Demolition Waste Management (MR Credit 5)(1-2 pts.)** Option 1: Credit requires diversion of 50% of construction and demolition material from at least three material streams or 75% including waste from 4 material streams. Although LEED does not prescribe the strategy to be used, the credit involves additional rigor above the Federal Requirements because of the requirement to address multiple construction waste streams. The more waste streams that are diverted, the higher the percentage of waste that must be recycled. Option 2: Reduce total waste generated to no more than 2.5 lbs/SF
What is the baseline or point of comparison?	Total non-hazardous construction, demolition and land clearing materials		**MRp1:** None **MRp2**: None **MRc5:** Option 1: Total C&D debris excluding hazardous waste, land-clearing debris, soil, and landscaping materials. Option 2: None
What is the range of requirements to achieve the metric?	N/A		**MRp1:** No specific metrics **MRp2**: No specific metrics **MRc5:** Option 1: 50% for 3 materials streams, or 75% for 4 material streams Option 2: 2.5 lbs./sf
What standards or tools are required for the metric?	N/A		N/A

Ozone Depleting Compounds

Materials

Review Questions	Federal Requirements (NC)		LEED v4 BD+C: New Construction (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account lifecycle impacts.	◑	**Summary:** LEED v4 NC is related to but not directly aligned with the Federal Requirements. EA Prerequisite 4 supports the Federal Requirements by restricting the use of CFCs. EA Credit 6 requires a minimization or elimination of refrigeration compounds that contribute to ozone depletion and climate change. It is possible to achieve the prerequisite and credit without eliminating ozone depleting compounds as described in the Federal Requirements. In addition, LEED v4 NC only addresses refrigerants, rather than all product types addressed in the Montreal Protocol and referred to as EPP in the Federal Requirements. **Fundamental Refrigerant Management (EA Prerequisite 4)** Restricts the use of CFCs in buildings. For projects that have existing CFC equipment, phase-out is required. **Enhanced Refrigerant Management (EA Credit 6)(1 pt.)** Option 1: Do not use refrigerants, or use only refrigerants that have an ozone depletion potential (ODP) of zero and a global warming potential (GWP) of less than 50. Option 2: Addresses building refrigeration equipment on a life-cycle basis including equipment operations to access the life-cycle ozone depletion potential and global warming potential of refrigerants over the life of the equipment.
What is the baseline or point of comparison?	N/A		**EAp4:** Zero CFC-based refrigerants **EAc6:** Option 1: Zero ODP and <50 GDP Option 2: Total refrigerant impact per ton
What is the range of requirements to achieve the metric?	N/A		**EAp4:** Compliance **EAc6:** Compliance
What standards or tools are required for the metric?	Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990		U.S. EPA Clean Air Act, Title VI, Section 608, Refrigerant Recycling Rule

Appendix B: LEED v. 4 NC Conformance Methods: Measured, Calculated and Evidence of Intent

MCI Assessment:
LEED v4 BD+C: New Construction and Major Renovation (LEED NC)

M= Measured Performance
C= Calculated Performance
I= Evidence of Intent

GP	Guiding Principles New Construction and Major Renovations	LEED v4 NC
	Robustness – Integrated Principles	
I/M	Integrated Design	I/M
	Commissioning	
I	Building System Controls (Not in GP)	I/C/M
	Siting (Not in GP)	
I/C	Greenhouse Gas (Not in GP)	
Comments: Greenhouse Gas is considered C/M because a wide variety of strategies that are both C and M were identified in the Robustness table as supporting the Federal Requirement.		
	Energy	
C	Energy Efficiency	C
	On-Site Renewable Energy & Green Power	
I/M	Measurement and Verification	I/M
C/M	Benchmarking	
	Use ENERGY STAR, FEMP or EPEAT Products	N/A
Comments: Install meters is considered M because meters are installed in the project. LEED v4 requires project to provide any data to the USGBC for analysis, but does not require verification that the actual performance of the project meets or exceeds the design energy budget. ENERGY STAR is not required for use in the design process.		
	Water	
C	Indoor Water	C
I	Process Water	
	Outdoor Water	
C	Stormwater	

Appendix B: LEED v. 4 NC Conformance Methods: Measured, Calculated and Evidence of Intent

	Water-Efficient Products	I/C
Comments: Indoor water use reductions, as well as the project volumes of harvested rainwater are C because the volumes are calculated in both cases. The installation of WaterSense products, as well as water meters for indoor and outdoor water use, are M because they are required to be installed. Process water is considered M because measures identified in LEED are prescriptive and will be installed. Stormwater volumes are calculated. No option for stormwater will ensure ongoing performance in the context of an NC project, although requirements to incorporate best practices informed by calculations will ensure that future site work improves existing conditions.		
Resources/Materials		
I	Recycled Content	C
	Biobased Content	
I	Environmentally Preferable Products	I/C
	Waste and Materials Management	M
/M	Ozone Depleting Compounds	I/C
Comments: LEED v4 NC relies on the measured contributions based on environmental attributes such as recycled content, biobased materials, and environmentally preferable materials. The calculations consider weight, percent of product, and product costs. Construction waste management is measured according to weight or volume. LEED provides for a calculated approach in the case that ozone depleting compounds are not fully eliminated.		
Indoor Environment		
C	Ventilation	I/C
	Thermal Comfort	
C	Daylighting & Lighting Controls	C
I	Environmental Tobacco Smoke Control	I
	Moisture Control	I/C
M	Protect Indoor Air Quality During Construction	M
I	Low-Emitting Materials	I/C
	Acoustics (Not in GP)	/M

Appendix B: LEED v. 4 NC Conformance Methods: Measured, Calculated and Evidence of Intent

Comments:
Low-emitting materials may be achieved through either a compliance-based or calculated approach.

Daylighting would ideally be measured, but because it is primarily a design consideration, calculating it through simulations is the preferred approach. The simulations are effectively a design tool to improve daylighting outcomes and performance of the building.

Appendix C: LEED v. 4 EB Robustness Review

Robustness Key (from section 4.9 of the 2012 Study)	
●	Full circles (green) mean that the Federal requirement would automatically be met if the building was certified because the system and Federal requirements fully align, and the requirement within the green building certification system is a prerequisite.
◕	Three-quarter circles (green) mean that the certification system has an option (e.g.., point, credit, etc.) that meets the Federal Requirement; if that option is included in the certification package, the Federal Requirement would be met.
◑	A half circle (yellow) means the certification system includes an option related to but not directly aligned with the Federal Requirement. The certification systems may have a lower standard, different baselines, different calculation methods, or different ways to document compliance with the Federal Requirement.
○	An empty circle means the Federal Requirement is not an identified component within the certification system.

NOTE: LEED v4 does not number credits in any of the LEED rating system reference guides. However, the USGBC published LEED v4 checklists do contain credit numbers. To facilitate the organization of content, the tables include credit numbers consistent with the nomenclature of the LEED v4 checklists and past LEED rating systems.

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Integrated Assessment, Operation and Management			
Does the metric help a building meet a current Federal Requirement?	Integrated Assessment, Operation, and Management. Use an integrated team to develop and implement policy regarding sustainable operations and maintenance. • Incorporate sustainable operations and maintenance practices within the appropriate Environmental Management System (EMS) • Assess existing condition and operational procedures of the building and major building systems and identify areas for improvement • Establish operational performance goals for energy, water, material use and recycling, and indoor environmental quality, and ensure incorporation of these goals throughout the remaining lifecycle of the building • Incorporate a building management plan to ensure that operating decisions and tenant education are carried out with regard to integrated, sustainable building operations and maintenance • Augment building operations and maintenance as needed using occupant feedback on work space satisfaction.	◑	**Summary:** LEED v4 EB is related to but not directly aligned with the Federal Requirements for Integrated Assessment, Operation and Management because only some of the Federal Requirements are addressed in LEED v4 EB. However, the intent of LEED Accredited Professional (IN Credit 2) is to "encourage the team integration required by a LEED project and to streamline the application and certification process." A successful LEED v4 EB process is likely to foster an integrated team. Additionally, the role of the LEED AP and the associated LEED Accredited Professional (IN Credit 2) is intended to facilitate team integration. Use of an Environmental Management System is not required by LEED v4 EB, although in many ways, LEED v4 EB serves many of the same functions of an EMS by requiring policies to be developed, maintained and implemented. An assessment of the building's existing condition and operational procedures, and identification of areas for improvement, is an intrinsic part of the LEED v4 EB program. The conditions and procedures that are addressed as part of the LEED v4 EB process is dependent upon which optional credits a project team decides to pursue. In pursuing LEED v4 EB prerequisites: Energy Efficiency Best Management Practices (EA Prerequisite 1), Minimum Energy Performance (EA Prerequisite 2), Indoor Water Use Reduction (WE Prerequisite 1), Ongoing Purchasing and Waste Policy (MR Prerequisite 1), Facility Maintenance and Renovation Policy (MR Prerequisite 2), and Minimum Indoor Air Quality Performance (EQ Prerequisite 1), establishing and meeting minimum performance goals for energy, water, material use and recycling, and indoor environmental quality are required. There is no LEED v4 EB component that directly addresses a building management plan for operating decisions and tenant education. Occupant Comfort Survey (EQ Credit 10) meets the Federal Requirement to use occupant feedback to inform building operations and maintenance. **LEED Accredited Professional (IN Credit 2)** Awards credit to the project for the participation of a LEED AP with a specialty appropriate to the project. **Energy Efficiency Best Management Practices (EA Prerequisite 1)** Requires projects to establish current energy performance and set energy performance goals. **Minimum Energy Performance (EA Prerequisite 2)** Requires projects to establish current energy performance. A minimum level of performance must be demonstrated to certify under LEED v4 EB. **Indoor Water Use Reduction (WE Prerequisite 1)** Requires projects to establish current water performance. A minimum level of performance must be demonstrated to certify under LEED v4 EB. **Ongoing Purchasing and Waste Policy (MR Prerequisite 1)** Requires projects to establish purchasing and waste performance goals. **Facility Maintenance and Renovation Policy (MR Prerequisite 2)** Requires projects to establish purchasing and waste performance goals. **Minimum Indoor Air Quality Performance (EQ Prerequisite 1)** Requires projects to establish ventilation performance. A minimum level of performance must be demonstrated to certify under LEED v4 EB. **Occupant Comfort Survey (EQ Credit 10)** Requires the administration of an occupant survey that assesses acoustics, building cleanliness, indoor air quality, lighting, and thermal comfort, at minimum. Corrective action planning must be undertaken when more than 20% occupants express dissatisfaction with comfort issues.

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the baseline or point of comparison?	N/A		**INc2:** N/A **EAp1:** N/A **EAp2:** N/A **WEp1:** N/A **MRp1:** N/A **MRp2:** N/A **EQp1:** N/A **EQc10:** N/A
What is the range of requirements to achieve the metric?	N/A		**INc2:** Compliance **EAp1**: Compliance **EAp2:** Compliance **WEp1:** Compliance **MRp1:** Compliance **MRp2:** Compliance **EQp1:** Compliance **EQc10:** Corrective action if 20% or more of the occupants express dissatisfaction with comfort.
What standards or tools are required for the metric?	N/A		ASHRAE Procedures for Commercial Building Energy Audits, 2nd edition, Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager tool, ASHRAE Standard 90.1-2010, or local equivalent, Water Use Calculator provided by the USGBC, Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3), ASHRAE Standard 62.1–2010, or local equivalent

Commissioning

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Employ recommissioning, tailored to the size and complexity of the building and its system components, in order to optimize and verify performance of fundamental building systems. Commissioning must be performed by an experienced commissioning provider. When building commissioning has been performed, the commissioning report, summary of actions taken, and schedule for recommissioning must be documented. In addition, meet the requirements of EISA 2007, Section 432 and associated FEMP guidance. Building recommissioning must have been performed within four years prior to reporting a building as meeting the Guiding Principles.		**Summary:** If the LEED v4 EB Existing Building Commissioning—Analysis (EA Credit 1), Existing Building Commissioning—Implementation (EA Credit 2), and Ongoing Commissioning (EA Credit 3) are achieved, then the project will meet the Federal Requirements. For most projects, achieving Existing Building Commissioning—Analysis (EA Credit 1) and Existing Building Commissioning—Implementation (EA Credit 2) will meet all of the Federal Requirements, but the difference in recommissioning in a four year cycle, as opposed to a five year cycle (required by LEED v4 EB) could result in a project being granted a pass in updated recommissioning when it would otherwise be required. **Existing Building Commissioning—Analysis (EA Credit 1)** Requires existing building commissioning or an energy audit that follows the requirements of ASHRAE Level 2, Energy Survey and Analysis. USGBC's Recertification Guidance published October 2013 states that the commissioning analysis phase must be completed at least once every five years. This timeframe is one year longer than the Federal Requirement, but does not prohibit projects from completing commissioning on a shorter timeframe. **Existing Building Commissioning—Implementation (EA Credit 2)** Requires implementation of no-cost and low-cost operational improvements and the development of a five-year plan for capital improvements found during the commissioning analysis phase. Requires building operator training for new or substantially altered equipment or systems. Also requires a formal tracking and verification plan for the implemented energy conservation measures. **Ongoing Commissioning (EA Credit 3)** Requires projects to establish an ongoing commissioning process that includes planning, point monitoring, system testing, performance verification, corrective action response, ongoing measurement, and documentation to proactively address operating problems in commissioned systems. The USGBC Recertification Guidance also states that the ongoing commissioning plan must have a 24-month cycle.
What is the baseline or point of comparison?	N/A		**EAc1:** N/A **EAc2:** N/A **EAc3:** N/A
What is the range of requirements to achieve the metric?	N/A		**EAc1:** Compliance **EAc2:** Compliance **EAc3:** Compliance
What standards or tools are required for the	EISA 2007 Section 432, FEMP Guidance for O&M Best		ASHRAE Procedures for Commercial Building Energy Audits, 2nd edition

Building System Controls (Not in GP)

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies building system controls as an element of indoor environmental quality to be considered during the certification system review.	◑	**Summary:** LEED v4 EB is related to but does not directly align with the Federal Requirement for building system controls (Building Automation System). Advanced energy metering can play an important role in a BAS, but does not provide the level of control to meet the intent of the requirement. Similarly, mechanical systems designed to maintain comfort within the parameters of ASHRAE 55-2010 provide some building level comfort management, but does not singularly constitute building system controls. There is no requirement for building automation systems in LEED v4 EB. **Building-Level Energy Metering (EA Prerequisite 3)** Projects must have building-level energy meters or submeters that can be aggregated to provide building-level data representing total building energy consumption (electricity, natural gas, chilled water, steam, fuel oil, propane, etc). Projects are required to share water data with the USGBC over a 5 year period. **Advanced Energy Metering (EA Credit 5) (2 pts.)** Projects must install advanced energy metering for all whole-building energy sources and major end uses that represent 20% or more of the total annual consumption of the building minus the plug load. The data collection system for the advanced metering must use a local area network, building automation system, wireless network, or comparable communication infrastructure. **Thermal Comfort (EQ Credit 3) (1 pt.)** Option 1: ASHRAE Standard 55-2010 Monitor building performance to the desired comfort criteria per: ASHRAE 55-2010 Option 2: ISO and CEN Standards Monitor building performance to the desired comfort criteria per: ISO 7730:2005 or CEN Standard EN 15251:2007.
What is the baseline or point of comparison?	N/A		**EAp3**: N/A **EAc5:** N/A **EQc3:** Option 1: ASHRAE Standard 55-2010 Option 2: ISO and CEN Standards
What is the range of requirements to achieve the metric?	N/A		**EAp3:** Compliance **EAc5:** Compliance **EQc3:** Option 1: Compliance (1 pt.) Option 2: Compliance (1 pt.)
What standards or tools are required for the	N/A		ASHRAE Standard 55-2010,ISOI 7730-2005, EN 15251:2007

Siting (Not in GP)

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies reduced impacts from transportation through building location and site design that promote access by public transportation as an element of indoor environmental quality to be considered during the certification system review.	◕	**Summary:** If the project achieves LEED v4 EB Alternative Transportation (LT Credit 1), it will meet the Federal Requirements pertaining to siting. **Alternative Transportation (LT Credit 1) (1-15 pts.)** Option 1: Conduct a transportation survey. Option 2: Meet the requirements of Option 1 by conducting a transit survey. In addition, demonstrate an alternative transportation rate of 10% to 70%. Option 3: Meet the requirements of Option 1 by conducting a transit survey. In addition, implement an alternative transportation program to reduce the conventional travel rates of building occupants.
What is the baseline or point of comparison?	N/A		Option 1: N/A Option 2: Alternative transportation rate Option 3: N/A
What is the range of requirements to achieve the metric?	N/A		Option 1: N/A (1 pt.) Option 2: 10% to 70% alternative transportation rate (3-15 pts.) Option 3: N/A (2 pts.)
What standards or tools are required for the	N/A		N/A

Greenhouse Gas (Not in GP)

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	E.O. 13423 and 13514 establish specific targets for agencies in building design, construction and operations in the areas of energy use, water use, greenhouse gas emissions, waste reduction, stormwater management, and facility siting. E.O. 13514 also requires reductions in greenhouse gas emissions.	●	**Summary:** Federal Requirements for Greenhouse Gas emissions pertain to agency-wide goals. As such, they do not have project-specific requirements. LEED v4 EB Energy Efficiency Best Management Practices (EA Prerequisite 1) and Minimum Energy Performance (EA Prerequisite 2) contributes to the Federal Goals for every project that pursues LEED v4 EB. Additionally, Optimize Energy Performance (EA Credit 4) and Renewable Energy and Carbon Offsets (EA Credit 7) are also related to the reduction of greenhouse gas emissions from energy use. The credits referenced below represent the spectrum of opportunity for reducing GHG emissions in LEED v4 EB projects. **Energy Efficiency Best Management Practices (EA Prerequisite 1)** LEED v4 EB requires projects to conduct an energy audit that meets the ASHRAE preliminary energy use analysis and an ASHRAE Level 1 walk-through assessment. A plan must be prepared that contains the necessary information to operate the building efficiently. **Minimum Energy Performance (EA Prerequisite 2)** LEED v4 EB requires energy benchmarking using ENERGY STAR for all buildings that are eligible to use the ENERGY STAR program. Laboratory buildings (where net lab area is at least 10% of gross area) must use the Labs21 program to benchmark energy use. Projects must demonstrate 12 months continuous energy data tracking. Therefore it is the responsibility of the project to continue to track energy year over year and compare annual performance against previous years. **Optimize Energy Performance (EA Credit 4) (3-20 pts.)** Additional points are available to projects that exceed the minimum energy performance threshold set by Minimum Energy Performance (EA Prerequisite 2). **Renewable Energy and Carbon Offsets (EA Credit 7) (1-5 pts.)** Meet at least some of the building's total energy use directly with on-site renewable energy systems and/or a meet at least some of the building's total energy use by purchasing green power, REC, and/or carbon offsets for a two-year period. Renewable energy is awarded a point for each 1.5% of energy that is produced. Carbon offsets earn points per 25%, limited to 100% (4 points). The following LEED Credits also support related reductions of GHG emissions in buildings. They are discussed throughout this document. **Alternative Transportation (LT Credit 1) (1-15 pts.)** **Fundamental Refrigerant Management (EA Prerequisite 4)** **Enhanced Refrigerant Management (EA Credit 8) (1 pt.)** **Ongoing Purchasing and Waste Policy (MR Prerequisite 1)** **Facility Maintenance and Renovation Policy (MR Prerequisite 2)** **Purchasing—Ongoing (MR Credit 1) (1 pt.)** **Purchasing—Facility Maintenance and Renovation (MR Credit 3) (2 pts.)** **Solid Waste Management—Ongoing (MR Credit 4) (2 pts.)** **Solid Waste Management—Facility Maintenance and Renovation (MR Credit 5) (2 pts.)**

Integrative Principles

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the baseline or point of comparison?	N/A		**EAp1:** N/A **EAp2:** Case 1: National average energy use Case 2: National average energy use, or measured historic energy use, using data for at least 3 consecutive years of the previous 5 years **EAc4:** Case 1: National average energy use Case 2: National average energy use, or measured historic energy use, using data for at least 3 consecutive years of the previous 5 years **EAc7:** Annual total energy use (electric and non-electric)
What is the range of requirements to achieve the metric?	N/A		**EAp1:** Compliance **EAp2:** Case 1: ENERGY STAR score of 75 Case 2: 25% reduction from national average energy use, or 25% reduction from historic baseline energy use **EAc4:** Case 1: ENERGY STAR score of 76 to 95 (3 - 20 points) Case 2: 26% to 45% reduction compared to national average (3 - 20 points), or 27% to 45% improvement over historical data (2 to 14 points) **EAc7:** 1.5%- 7.5% on-site renewable energy (1 - 5 pts.) 25% - 100% carbon offsets (1-4 pts.)
What standards or tools are required for the	N/A		AHSRAE Procedures for Commercial Building Energy Audits, 2nd edition, Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager tool, ASHRAE Standard 90.1-2010, or local equivalent, Center for Resource Solutions Green-e Program

Energy

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Energy Efficiency			
Does the metric help a building meet a current Federal Requirement?	Three options can be used to measure energy efficiency performance: • Option 1: Receive an ENERGY STAR rating of 75 or higher or an equivalent Labs21 Benchmarking Tool score for laboratory buildings, • Option 2: Reduce measured building energy use by 20% compared to building energy use in 2003 or a year thereafter with quality energy use data, or • Option 3: Reduce energy use by 20% compared to the ASHRAE 90.1-2007 baseline building design if design information is available. Use ENERGY STAR, FEMP-designated Energy Efficient Products, and EPEAT certified products and equipment where available.	◑	**Summary:** For buildings eligible to receive an ENERGY STAR score, LEED v4 EB Minimum Energy Performance (EA Prerequisite 2) meets Option 1 of the Federal Requirements for minimum energy performance. For buildings ineligible to receive an ENERGY STAR score, LEED v4 EB Minimum Energy Performance (EA Prerequisite 2) Case 2 is more aggressive than Option 2 of the Federal Requirements (LEED v4 EB requires a 25% reduction from a historical baseline while the Federal Requirements require 20% reduction. Further, LEED v4 EB Minimum Energy Performance (EA Prerequisite 2) requires an average of 3 years' consecutive data to establish the baseline for comparison, while the Federal Requirement requires the use of a single year of data only. Note that LEED v4 EB provides no option for energy modeling relative an ASHRAE baseline as described in Federal Requirement Option 3. While LEED v4 meets or exceeds the Federal Requirements for actual energy efficiency performance, LEED v4 EB MR Credit 1 only relates to the Federal Requirement for ENERGY STAR and EPEAT products and doesn't include FEMP designated products specifically. Furthermore, LEED only requires 40% by cost of products to meet the referenced ENERGY STAR or EPEAT standard, while the Federal Requirements require use where available. Because of this misalignment around FEMP and EPEAT products, LEED v4 EB is related to but does not align with the Federal Requirements. It is possible to earn the LEED MRc1 credit without complying with the Federal Requirement for ENERGY STAR, FEMP, or EPEAT products. **Energy Efficiency Best Management Practices (EA Prerequisite 1)** LEED v4 EB requires projects to conduct an energy audit that meets the ASHRAE preliminary energy use analysis and an ASHRAE Level 1 walk-through assessment. A plan must be prepared that contains the necessary information to operate the building efficiently. **Minimum Energy Performance (EA Prerequisite 2)** Case 1: Achieve an ENERGY STAR score of at least 75. Case 2: Projects not eligible for an ENERGY STAR rating can compare their energy performance against that of comparable buildings. Demonstrate energy efficiency performance that is at least 25% better than the median energy performance for typical buildings of similar type. Laboratory buildings (where net lab area is at least 10% of gross area) must use Labs21 and meet the 25% better than median energy performance threshold. If a project is not eligible for an ENERGY STAR rating and national average source energy data for comparable buildings is not available, the project can benchmarking against its historic energy use. The baseline is energy data from 3 consecutive years of the previous 5. Energy use must be reduced by 25%. **Optimize Energy Performance (EA Credit 4) (3-20 pts.)** Case 1: Additional points are awarded for ENERGY STAR scores above 75. Case 2: Additional points are awarded for buildings that demonstrate energy efficiency performance at least 26% better than the median energy performance for typical buildings of similar type. This applies to laboratory buildings using Labs21 as the benchmarking standard.
Continued			**Purchasing—Ongoing (MR Credit 1)** Purchase electric-powered equipment that has at least one of the following labels: EPEAT (silver or better) or ENERGY STAR, for at least 40% of purchases, by cost. Create a phase-out plan to replace remaining products with compliant equipment at the end of their useful life.

Energy

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the baseline or point of comparison?	ENERGY STAR; energy use in 2003; ASHRAE 90.1-2007		**EAp1:** N/A **EAp2:** Case 1: National average energy use Case 2: National average energy use, or measured historic energy use, using data for at least 3 consecutive years of the previous 5 years **EAc4:** Case 1: National average energy use Case 2: National average energy use, or measured historic energy use, using data for at least 3 consecutive years of the previous 5 years **MRc1**: Total electric-powered goods purchases, by cost
What is the range of requirements to achieve the metric?	Score of 75 or 20% reduction		**EAp1:** Compliance **EAp2**: Case 1: ENERGY STAR score of 75 Case 2: 25% reduction from national average energy use, or 25% reduction from historic baseline energy use **EAc4**: Case 1: ENERGY STAR score of 76 to 95 (3 - 20 points) Case 2: 26% to 45% reduction compared to national average (3 - 20 points), or 27% to 45% improvement over historical data (2 to 14 points) **MRc1**: 40% ENERGY STAR or EPEAT labeled, by cost
What standards or tools are required for the	ENERGY STAR; ASHRAE 90.1-2007		AHSRAE Procedures for Commercial Building Energy Audits, 2nd edition, Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager tool, ASHRAE Standard 90.1-2010, or local equivalent

On-Site Renewable Energy and Green Power

Energy

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Per the Energy Independence and Security Act (EISA) Section 523, meet at least 30% of the hot water demand through the installation of solar hot water heaters, when lifecycle cost effective. The 2013 Presidential Memorandum on Federal Leadership in Energy Management requires that agencies meet 20% of total electric energy consumption through renewable sources by fiscal year 2020. The Memorandum outlines acceptable renewable sources to include: * agency-funded renewable energy on-site with renewable energy certificate retained; * on-site or off-site renewable energy developed by contract, with renewable energy certificates retained for the contract's life; * purchasing electricity and corresponding renewable energy certificates; * purchasing renewable energy certificates. ``Renewable energy certificates'' means the technology and environmental (non-energy) attributes that represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource, and can be sold separately from the underlying generic electricity with which it is associated.		**Summary:** LEED v4 EB is related to but does not directly align with the Federal Requirements for on-Site Renewable Energy & Green Power. LEED v4 EB Renewable Energy and Carbon Offsets (EA Credit 7) awards credit to projects that produce between 1.5%-7.5% of their energy requirement on-site through renewable energy sources. LEED v4 EB also allows for off-site owned or leased renewable energy systems to be awarded credit if RECs are also acquired. In addition, LEED v4 EB awards credit for green power and carbon offset purchases. These configurations of energy production, use, REC retainment/purchase as described in the Federal Requirements for points (i) and (ii) align fully with LEED v4 EB requirements for renewable energy. Similarly, the agency-wide Federal Requirements for points (iii) and (iv) address green power and both points are supported by Renewable Energy and Carbon Offsets (EA Credit 7) for Renewable Energy and Carbon Offsets. LEED requires all Green Power and Carbon Offsets to be Green-e certified. The Federal Requirements have no such qualifications. Because LEED v4 EB Renewable Energy and Carbon Offsets (EA Credit 7) permits a range of applicable types of renewable energy including solar pv, tidal, wind, and geothermal, LEED v4 EB is related to but not directly aligned with the Federal Requirement for solar hot water. **Renewable Energy and Carbon Offsets (EA Credit 7) (1-5 pts.)** Meet at least some of the building's total energy use directly with on-site renewable energy systems and/or a meet at least some of the building's total energy use by purchasing green power, REC, and/or carbon offsets for a two-year period. Renewable energy is awarded a point for each 1.5% of energy that is produced. Carbon offsets earn points per 25%, limited to 100% (4 points).
What is the baseline or point of comparison?	N/A		Annual total energy use (electric and non-electric)
What is the range of requirements to achieve the metric?	N/A		1.5%- 7.5% on-site renewable energy (1-5 pts.) 25% -100% carbon offsets (1-4 pts.)

Energy

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What standards or tools are required for the	N/A		Center for Resource Solutions Green-e Program
Is on-site generation and purchases of green power treated	No		Yes, there are different performance thresholds for on-site generation and purchased green power/RECs/carbon offsets

Measurement and Verification

Energy

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Per the Energy Policy Act of 2005 (EPAct) Section 103, install building level electricity meters in new major construction and renovation projects to track and continuously optimize performance. Per EISA Section 434, include equivalent meters for natural gas and steam, where natural gas and steam are used. The Presidential Memo on Energy Management (2013) requires agencies to install (where cost-effective and appropriate) building energy meters, energy sub-meters and water meters, and to enter metered data into the EPA ENERGY STAR Portfolio Management System to support benchmarking. Annual energy performance data will continue to be publicly disclosed through DOE's web-based tracking system.	●	**Summary:** LEED v4 EB Building—Level Water Metering (WE Prerequisite 2), Minimum Energy Performance (EA Prerequisite 2), and Building-Level Energy Metering (EA Prerequisite 3) meet the Federal Requirements. Building-Level Energy Metering (EA Prerequisite 3) meets the Federal Requirement for building level electricity, natural gas and steam meters, as well as tracking data. Building-Level Energy Metering (WE Prerequisite 3) meets the Federal Requirement for building-level water meters. For each prerequisite, LEED v4 EB requires that energy and water data be shared with the USGBC for 5 years and provided in an approved template. In addition, LEED v4 EB Water Metering (WE Credit 4) and Advanced Energy Metering (EA Credit 5) both support the installation of sub-meters for related systems. Minimum Energy Performance (EA Prerequisite 2) requires all projects to have an ENERGY STAR Score of 75 or more for all applicable buildings, meaning that energy data is required to be reported to ENERGY STAR Portfolio Manager. Recertification is required every 5 years, aligning with the USGBC's requirement for projects to provide energy and water data. **Building—Level Water Metering (WE Prerequisite 2)** Requires meters that measure all potable water usage for the building and grounds. Projects are required to share water data with the USGBC over a 5 year period. **Water Metering (WE Credit 4)** Awards additional credit for submetering the following water subsystems: irrigation, indoor plumbing fixtures and fittings, cooling towers, domestic hot water, reclaimed water, other process water. **Minimum Energy Performance (EA Prerequisite 2)** Case 1: Achieve an ENERGY STAR score of at least 75. Case 2: Projects not eligible for an ENERGY STAR rating can compare their energy performance against that of comparable buildings. Demonstrate energy efficiency performance that is at least 25% better than the median energy performance for typical buildings of similar type. Laboratory buildings (where net lab area is at least 10% of gross area) must use Labs21 and meet the 25% better than median energy performance threshold. If a project is not eligible for an ENERGY STAR rating and national average source energy data for comparable buildings is not available, the project can benchmark against its historic energy use. The baseline is energy data from 3 consecutive years of the previous 5. Energy use must be reduced by 25%. **Building-Level Energy Metering (EA Prerequisite 3)** Projects must have building-level energy meters or submeters that can be aggregated to provide building-level data representing total building energy consumption (electricity, natural gas, chilled water, steam, fuel oil, propane, etc). Projects are required to share water data with the USGBC over a 5 year period.
Continued			**Advanced Energy Metering (EA Credit 5) (2 pts.)** Projects must install advanced energy metering for all whole-building energy sources and major end uses that represent 20% or more of the total annual consumption of the building minus the plug load.

Energy

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the baseline or point of comparison?	N/A		**WEp2:** N/A **WEc4:** N/A **EAp2:** Case 1: National average energy use Case 2: National average energy use, or measured historic energy use, using data for at least 3 consecutive years of the previous 5 years **EAp3**: N/A **EAc5:** N/A
What is the range of requirements to achieve the metric?	N/A		**WEp2:** Potable water metering **WEc4:** Submeter 2 water subsystems, submeter 4 or more water subsystems (1, 2 pts.) **EAp2:** Case 1: ENERGY STAR score of 75 Case 2: 25% reduction from national average energy use, or 25% reduction from historic baseline energy use **EAp3:** Compliance **EAc5:** Compliance
What standards or tools are required for the	EPAct 2005; EISA 2007		Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager tool, ASHRAE Standard 90.1-2010, or local equivalent
Benchmarking			
Does the metric help a building meet a current Federal Requirement?	Compare annual performance data with previous years' performance data, preferably by entering annual performance data into the ENERGY STAR Portfolio Manager. For building and space types not available in ENERGY STAR, use an equivalent benchmarking tool such as the Labs21 benchmarking tool for laboratory buildings.	●	**Summary:** LEED v4 EB meets the Federal Requirement via the Minimum Energy Performance (EA Prerequisite 2) prerequisite. **Minimum Energy Performance (EA Prerequisite 2)** LEED v4 EB requires energy benchmarking using ENERGY STAR for all buildings that are eligible to use the ENERGY STAR program. Laboratory buildings (where net lab area is at least 10% of gross area) must use the Labs21 program to benchmark energy use. Projects must demonstrate 12 months continuous energy data tracking. Therefore it is the responsibility of the project to continue to track energy year over year and compare annual performance against previous years. **Optimize Energy Performance (EA Credit 4) (3-20 pts.)** Case 1: Additional points are awarded for ENERGY STAR scores above 75. Case 2: Additional points are awarded for buildings that demonstrate energy efficiency performance at least 26% better than the median energy performance for typical buildings of similar type. This applies to laboratory buildings using Labs21 as the benchmarking standard.
What is the baseline or point of comparison?	Previous year		**EAp2:** ENERGY STAR Score of 75 **EAc4:** ENERGY STAR Score of 75
What is the range of requirements to achieve the metric?			**EAp2:** Compliance **EAc4** Case 1: ENERGY STAR score of 76 to 95 (3 - 20 pts.) Case 2: 26% to 45% reduction compared to national average (3 - 20 pts.), or 27% to 45% improvement over historical data (2 to 14 pts.)
What standards or tools	ENERGY STAR; Labs21		Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager tool, ASHRAE Standard 90.1-2010, or local equivalent

Water

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Indoor Water			
Does the metric help a building meet a current Federal Requirement?	Two options can be used to measure indoor potable water use performance: • Option 1: Reduce potable water use by 20% compared to a water baseline calculated for the building. The water baseline, for buildings with plumbing fixtures installed in 1994 or later, is 120% of the Uniform Plumbing Codes 2006 or the International Plumbing Codes 2006 fixture performance requirements. The water baseline for plumbing fixtures older than 1994 is 160% of the Uniform Plumbing Codes 2006 or the International Plumbing Codes 2006 fixture performance requirements, or • Option 2: Reduce building measured potable water use by 20% compared to building water use in 2003 or a year thereafter with quality water data.	◕	**Summary:** The Federal Requirement's baseline and the LEED v4 EB baseline are more or less the same (with minor differences). If a project achieves the LEED v4 EB Indoor Water Use Reduction (WE Credit 2) at the 20% level (earning three points) using Option 1, it will meet the Federal Requirements. Baseline note: For buildings where occupancy is dated before 1995, the LEED v4 EB baseline is 150% of water use that would result if all fixtures met UPC/IPC 2006. This is slightly more stringent than the Federal baseline of 160% of water use that would result if all fixtures met UPC/IPC 2006. For buildings where occupancy is dated 1995 or later, the baseline 120% of UPC/IPC 2006 is consistent with the Federal Requirement baseline for buildings with plumbing fixtures installed in 1994 or later. Therefore, buildings of a 1995 vintage or later that meet the LEED v4 EB prerequisite will also meet the Federal Requirements. Buildings built between 1994-1995, or those built before 1994 but which have had major water fixture upgrades since then, will have different baselines in LEED v4 EB and the Federal Requirements. **Indoor Water Use Reduction (WE Prerequisite 1)** Option 1: Maintain potable water use compared to a calculated baseline. The baseline is set depending on the year of occupancy. For a building with a certificate of occupancy dated 1995 or later, the baseline is 120% of the Uniform Plumbing Codes 2006 or the International Plumbing Codes 2006 fixture performance requirements. For a building with a certificate of occupancy dated before 1995, the baseline is 150% of the Uniform Plumbing Codes 2006 or the International Plumbing Codes 2006 fixture performance requirements. Option 2: Maintain potable water use by fixtures and fittings compared to measured water use for one year based on metered data. **Indoor Water Use Reduction (WE Credit 2) (1-5 pts.)** Option 1: Reduce calculated water use by 10% to 30% compared to the baseline described in Indoor Water Use Reduction (WE Prerequisite 1) through the use of higher efficiency fixtures. Option 2: Reduce potable water use by fixtures and fittings by <5% to 20%, based on installation of submetering ,compared to the baseline year of metered data.
What is the baseline or point of comparison?	120% or 160% of UPC/IPC 2006; 100% of water use in 2003		**WEp1:** Option 1: 120% or 150% of UPC/IPC 2006, depending on the certificate of occupancy date (1-5 pts.) Option 2: Metered fixture and fittings water use data from a prior year (no year specified)(1-5 pts.) **WEc2:** Option 1: 120% or 150% of UPC/IPC 2006, depending on the certificate of occupancy date (1-5 pts.) Option 2: Metered fixture and fittings water use data from a prior year (no year specified)(1-5 pts.)
What is the range of requirements to achieve the metric?	20%		**WEp1:** Option 1: 0% reduction Option 2: 0% reduction **WEc2:** Option 1: 10%, 15%, 20%, 25%, 30% reduction (1-5 points) Option 2: <5%, 5%, 10%, 15%, 20% reduction (1-5 points)

Water

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What standards or tools are required for the metric?	Uniform Plumbing Code (UPC) or International Plumbing Code (IPC)		Water Use Calculator provided by the USGBC
Process Water			
Does the metric help a building meet a current Federal Requirement?	Per EPAct 2005 Section 109, when potable water is used to improve a building's energy efficiency, deploy lifecycle cost effective water conservation measures.		**Summary:** If a project achieves LEED v4 EB Cooling Tower Water Use (WE Credit 3) the Federal Requirement will be met. **Cooling Tower Water Use (WE Credit 3)** Conduct a potable water analysis, calculate cycles of concentration, and adjust cooling tower or evaporative condenser settings for the maximum number of cycles without exceeding concentration levels or affecting condenser operation.
What is the baseline or point of comparison?	N/A		Cooling tower cycles
What is the range of requirements to achieve the metric?	N/A		< 10 cycles, ≥ 10 cycles (2, 3 points)
What standards or tools are required for	EPAct 2005 Section 109		N/A
Outdoor Water			
Does the metric help a building meet a current Federal Requirement?	Three options can be used to measure outdoor potable water use performance: • Option 1: Reduce potable irrigation water use by 50% compared to conventional methods, or • Option 2: Reduce building related potable irrigation water use by 50% compared to measured irrigation water use in 2003 or a year thereafter with quality water data, or • Option 3: Use non-potable irrigation water.		**Summary:** If a project achieves LEED v4 EB Outdoor Water Use Reduction (WE Credit 1) Option 1, the Federal Requirement Option 3 would be met. However, the Outdoor Water Use Reduction (WE Credit 1) thresholds for reducing water use in Option 2 and Option 3 are 30 and 40%, which are less than the Federal Requirement threshold of 50%, and these options would not be considered to meet the Federal Requirements. In addition, the baselines and calculation methodologies are different between Outdoor Water Use Reduction (WE Credit 1) Options 2 and 3 and the Federal Requirements, and additional effort will be required to document compliance with both programs. **Outdoor Water Use Reduction (WE Credit 1) (1-2 pts.)** Option 1: Use no water for irrigation Option 2: Reduce irrigation water use compared to a calculated baseline using the U.S. EPA WaterSense Water Budget Tool. The Federal Requirement assesses water reduction against "conventional methods." Option 3: Reduce irrigation water use compared to historic use based on metered data. The baseline is the annual average of at least 3 years of consecutive data out of the last 5 years. The Federal Requirement specifies a baseline of any year after 2003 with good data.
What is the baseline or point of comparison?	Conventional water use or measured use in 2003		Option 1: Zero water use for irrigation Option 2: U.S. EPA WaterSense Water Budget Tool calculated baseline Option 3: Annual average measured water use, using data for at least 3 consecutive years out of the last 5 years

Water

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the range of requirements to achieve the metric?	50%		Option 1: No water use (2 points) Option 2: 30%, 40% reduction (1, 2 points) Option 3: 30%, 40% reduction (1, 2 points)
What standards or tools are required for	N/A		U.S. EPA WaterSense Water Budget Tool
Measurement of Water Use			
Does the metric help a building meet a current Federal Requirement?	The installation of water meters for building sites with significant indoor and outdoor water use is encouraged. If only one meter is installed, reduce potable water use (indoor and outdoor combined) by at least 20% compared to building water use in 2003 or a year thereafter with quality water data.	◕	**Summary:** Projects must meet LEED v4 EB Building—Level Water Metering (WE Prerequisite 2), combined with the corresponding water reductions achieved in LEED v4 EB credits to meet the Federal Requirements. To comply with the Federal Requirement to reduce water use by 20%, all of the points available in WEc1, Option 2, would need to be achieved. LEED EB Water Metering (WE Credit 4) would further serve the intent of this Requirement by assigning credit for installing submeters for major water uses, including irrigation. **Building—Level Water Metering (WE Prerequisite 2)** Requires meters that measure all potable water usage for the building and grounds. Projects are required to share water data with the USGBC over a 5 year period. **Water Metering (WE Credit 4)** Awards additional credit for submetering the following water subsystems: irrigation, indoor plumbing fixtures and fittings, cooling towers, domestic hot water, reclaimed water, other process water.
What is the baseline or point of comparison?	Water use in 2003		**WEp2:** N/A **WEc4:** N/A
What is the range of requirements to achieve the metric?	20%		**WEp2:** Potable water metering **WEc4:** Submeter 2 water subsystems, submeter 4 or more water subsystems (1, 2 pts.)
What standards or tools are required for	N/A		N/A
Stormwater			

Water

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Employ strategies that reduce stormwater runoff and discharges of polluted water offsite. Per EISA Section 438, where redevelopment affects site hydrology, use site planning, design, construction, and maintenance strategies to maintain hydrologic conditions during development, or to restore hydrologic conditions following development, to the maximum extent that is technically feasible.	◑	**Summary:** LEED v4 EB is related to but not directly aligned with the Federal Requirements. If Rainwater Management (SS Credit 2) is achieved a portion of the Federal Requirement to reduce stormwater runoff and discharges of polluted water would be considered to be met. But because LEED v4 EB only requires that 25% of stormwater from hardscape surfaces are treated, this would fall short of a goal to restore site hydrology. Site Development-Protect or Restore Habitat (SS Credit 1) and Site Management (SS Credit 5) include requirements related to erosion and sedimentation control, and Site Improvement Plan (SS Credit 6) addresses long-term improvements to site hydrology. While these components speak to the intent of the Federal Requirement, achieving them may not be sufficient to meet the Federal Requirements set forth by EISA, which focuses on redevelopment activity and requires that projects maintain or restore hydrologic conditions to the maximum extent that is technically feasible. **Site Management Policy (SS Prerequisite 1)** Requires the development and adoption of environmentally sensitive site management practices. **Rainwater Management (SS Credit 2)** Requires the use of low-impact development (LID) practices to capture and treat water from 25% of the impervious surfaces for the 95th percentile storm event. **Site Management (SS Credit 5)** Requires the implementation of the site management policy and performance tracking. **Site Improvement Plan (SS Credit 6)** Develop a five-year site improvement plan that includes documentation of existing site conditions; site improvement objectives; performance standards to evaluate ongoing progress; and monitoring protocols. The plan must address hydrology, vegetation, and soils.
What is the baseline or point of comparison?	N/A		**SSp1:** N/A **SSc2:** 95th percentile storm event **SSc5:** N/A **SSc6:** N/A
What is the range of requirements to achieve the metric?	N/A		**SSp1:** N/A **SSc2:** Capture and treat water from 25% of the impervious surfaces (3 pts.) **SSc5:** N/A **SSc6:** N/A
What standards or tools are required for the metric?	U.S. EPA Technical Guidance on Implementing the Rainwater Runoff Requirements for Federal Projects under		N/A

Water-Efficient Products

Water

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Where available, use EPA's WaterSense-labeled products or other water conserving products. Choose irrigation contractors who are certified through a WaterSense-labeled program.	◑	**Summary:** LEED v4 EB is related to but not directly aligned with the Federal Requirements. LEED v4 EB requires the specification of WaterSense products but does not mention certified irrigation contractors. WaterSense labeled irrigation components are not required. **Indoor Water Use Reduction (WE Prerequisite 1)** Option 1: Maintain potable water use compared to a calculated baseline. Option 2: Maintain potable water use by fixtures and fittings compared to measured water use for one year based on metered data. For both options, WaterSense labeled products must be specified for replacement and retrofit fixtures. **Indoor Water Use Reduction (WE Credit 2)** Option 1: Reduce calculated water use by 10% to 30% compared to the baseline described in WEp1 through the use of higher efficiency fixtures. Option 2: Reduce potable water use by fixtures and fittings by <5% to 20% compared to the baseline year of metered data.
What is the baseline or point of comparison?	N/A		**WEp1:** Option 1: 120% or 150% of UPC/IPC 2006, depending on the certificate of occupancy date (1-5 pts.) Option 2: Metered fixture and fittings water use data from a prior year (no year specified) (1-5 pts.) **WEc2:** Option 1: 120% or 150% of UPC/IPC 2006, depending on the certificate of occupancy date (1-5 pts.) Option 2: Metered fixture and fittings water use data from a prior year (no year specified) (1-5 pts.)
What is the range of requirements to achieve the metric?	N/A		**WEp1:** Option 1: 0% reduction Option 2: 0% reduction **WEc2:** Option 1: 10%, 15%, 20%, 25%, 30% reduction (1-5 pts.) Option 2: <5%, 5%, 10%, 15%, 20% reduction (1-5 pts.)
What standards or tools are required for the metric?	EPA's WaterSense		Water Use Calculator provided by the USGBC

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Ventilation			
Does the metric help a building meet a current Federal Requirement?	Meet ASHRAE Standard 55-2004 Thermal Environmental Conditions for Human Occupancy and ASHRAE Standard 62.1-2007: Ventilation for Acceptable Indoor Air Quality.	●	**Summary**: LEED v4 EB EQ Case1, Option 1, meets the Federal Requirements for tenant spaces that do not have systems constraints. If the tenant space has systems constraints, it may not meet the Federal Requirement. LEED v4 EB Minimum Indoor Air Quality Performance (EQ Prerequisite 1), Case 1, Option 1, meets the Federal Requirements for ventilation (providing adequate fresh air for occupants), as required by ASHRAE Standard 62.1-2007. LEED v4 EB Minimum Indoor Air Quality Performance (EQ Prerequisite 1) references the updated and more stringent version of the standard; ASHRAE 62.1-2010. The Federal Requirement for thermal comfort (control for temperature, humidity, air speed, radiant heating and cooling) is addressed by a separate LEED v4 EB credit and the ASHRAE Standard 55-2004, and is discussed in the next section. The full circle rating is for ventilation only. Minimum Indoor Air Quality Performance (EQ Prerequisite 1) Case 2 can be considered best practice for tenant spaces that are unable to meet the requirement because of system constraints. **Minimum Indoor Air Quality Performance (EQ Prerequisite 1)** Case 1: System Able to Meet Required Outdoor Airflow Rates Option 1: Meet the minimum requirements of ASHRAE 62.1-2010, Sections 4-7, Ventilation for Acceptable Indoor Air Quality, or a local equivalent, whichever is more stringent. Case 2: Systems Unable to Meet Required Outdoor Airflow Rates If meeting the outdoor airflow rate is not possible due to building system constraints, conduct an assessment and meet minimum requirements as described. **Enhanced Indoor Air Quality Strategies (EQ Credit 2) (1-2 pts.)** Option 1: Enhanced IAQ Strategies (1 pt.) Includes requirements such as entryway systems, interior cross-contamination prevention and filtration depending on the ventilation system. Option 2:Additional Enhanced IAQ Strategies (1 pt.) Includes additional strategies depending on the ventilation system.
What is the baseline or point of comparison?	N/A		**EQ p1**: Case 1, Option 1: ASHRAE 62.1--2010 Case 2: N/A **EQ c2**: Option 1: N/A Option 2: N/A
What is the range of requirements to achieve the metric?	N/A		**EQp1:** Case 1, Option 1: Compliance Case 2: Compliance **EQc2:** Option 1: Compliance (1 pt.) Option 2: Compliance (1 pt.)

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What standards or tools are required for the metric?	ASHRAE Standard 62.1–2007 and ASHRAE Standard 55-2004 Thermal Environmental Conditions for Human		ASHRAE Standard 62.1–2010, or local equivalent,
Thermal Comfort			
Does the metric help a building meet a current Federal Requirement?	Meet ASHRAE Standard 55-2004 Thermal Environmental Conditions for Human Occupancy and ASHRAE Standard 62.1-2007: Ventilation for Acceptable Indoor Air Quality.		**Summary:** Achieving LEED v4 EB Thermal Comfort (EQ Credit 3) Option 1 meets the Federal Requirements for thermal comfort as required by ASHRAE 55-2004. LEED v4 EB Advanced Energy Metering (EA Credit 5) references the updated and more stringent version of the standard; ASHRAE 55-2010. The Federal Requirement for ventilation is addressed by ASHRAE Standard 62.1-2004 and is discussed in the previous section. The 3/4 circle rating is for thermal comfort only. T**hermal Comfort (EQ Credit 3:) (1 pt.)** Option 1: ASHRAE Standard 55-2010 Monitor building performance to the desired comfort criteria per: ASHRAE 55-2010 Option 2: ISO and CEN Standards Monitor building performance to the desired comfort criteria per: ISO 7730:2005 or CEN Standard EN 15251:2007. **Occupant Comfort Survey (EQ Credit 10) (1 pt.)** Requires the administration of an occupant survey that assesses acoustics, building cleanliness, indoor air quality, lighting, and thermal comfort, at minimum. Corrective action planning must be undertaken when more than 20% occupants express dissatisfaction with comfort issues.
What is the baseline or point of comparison?	N/A		**EQc3:** Option 1: ASHRAE Standard 55-2010 Option 2: ISO and CEN Standards **EQc10:** Corrective action if 20% or more of the occupants express dissatisfaction with comfort.
What is the range of requirements to achieve the metric?	N/A		**EQc3:** Option 1: Compliance (1 pt.) Option 2: Compliance (1 pt.) **EQc10:** Compliance (1 pt.)
What standards or tools are required for the metric?	ASHRAE Standard 55-2004 and ASHRAE Standard 62.1-2007: Ventilation for Acceptable Indoor Air Quality.		ASHRAE 55-2010, ISO 7730-2005 Ergonomics of the thermal environment, analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, European Standard EN 15251:2007, indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, Section A2
Integrated Pest Management			

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Use integrated pest management techniques as appropriate to minimize pesticide usage. Use EPA-registered pesticides only when needed.	◕	**Summary:** If the LEED v4 EB Integrated Pest Management (EQ Credit 9) is achieved, then the project will meet the Federal Requirements. **Integrated Pest Management (EQ Credit 9)** Have in place an integrated pest management (IPM) plan for the building and grounds within the project boundary.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		Compliance
What standards or tools are required for	EPA-registered pesticides (use only when needed)		N/A

Daylighting

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Automated lighting controls (occupancy/vacancy sensors with manual-off capability) are provided for appropriate spaces including restrooms, conference and meeting rooms, employee lunch and break rooms, training classrooms, and offices. Two options can be used to meet additional daylighting and lighting controls performance expectations: • Option 1: Achieve a minimum daylight factor of 2% (excluding all direct sunlight penetration) in 50% of all space occupied for critical visual tasks, or • Option 2: Provide occupant controlled lighting, allowing adjustments to suit individual task needs, for 50% of regularly occupied spaces.	◑	**Summary:** LEED v4 EB is related to but not directly aligned with the Federal Requirements. A majority of the Federal Requirements can be achieved if a project achieves Interior Lighting (EQ Credit 4) using Option 2 and Daylight and Quality Views (EQ Credit 5) using Option 1, although LEED v4 EB does not have a requirement for automated lighting controls (occupancy/vacancy sensors) as described in the Federal Requirements. **Interior Lighting (EQ Credit 4)** Option 1: Document lighting controls for regularly occupied spaces. For at least 50% of individual occupant spaces, have in place individual lighting controls that enable occupants to adjust the lighting to suit their individual tasks and preferences, with at least three lighting levels or scenes (on, off, midlevel). Interior Lighting (EQ Credit 4) Option 1 does not recognize automated lighting controls (occupancy/vacancy sensors) as a compliant strategy so Option 1 does not meet the Federal Requirement. Option 2: Demonstrate lighting quality through four of eight strategies outlined in the Reference Guide, including lighting controllability in regularly occupied spaces. Option 2 meets the Federal Requirement for lighting. **Daylight and Quality Views (EQ Credit 5)** Option 1: Compliance is based on measured illuminance levels. Achieve illuminance levels between 300 lux and 3,000 lux for at least 50% of the regularly occupied floor area. Although LEED v4 EB uses a different metric and calculation methodology than the Federal Requirements, LEED4 EB's metric of 300 lux is likely greater than a daylight factor of 2% (the latter depends on outdoor conditions, although even at full daylight, outdoor light levels are ~10,000 lux, which would make a 2% daylight factor = 200 lux, less than the 300 specified by LEED v4 EB). Option 2: Compliance is based on access to views. Achieve a direct line of sight to the outdoors via vision glazing for 50% of all regularly occupied floor area. Additionally, 50% of all regularly occupied floor area must have at least two of four kinds of views outlined in the Reference Guide. Views are not addressed by the Federal Requirements, so Option 2 does not align. Note: Lux = .0929 foot candles **Occupant Comfort Survey (EQ Credit 10) (1 pt.)** Requires the administration of an occupant survey that assesses acoustics, building cleanliness, indoor air quality, lighting, and thermal comfort, at minimum. Corrective action planning must be undertaken when more than 20% occupants express dissatisfaction with comfort issues.
What is the baseline or point of comparison?	All space occupied for critical visual task		**EQc4**: Option 1: Number of individual occupant spaces and shared multi-occupant spaces Option 2: Lighting quality in regularly occupied floor area and throughout the building **EQc5:** Option 1: Measured lighting levels in the regularly occupied floor area Option 2: Kinds of views in regularly occupied floor area **EQc10:** Corrective action if 20% or more of the occupants express dissatisfaction with comfort.

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the range of requirements to achieve the metric?	50%		**EQc4**: Option 1: Compliant lighting controls in 50% individual occupant spaces and 100% of shared multi-occupant spaces (1 pt.) Option 2: Meet four of eight lighting quality strategies outlined in the Reference Guide (1 pt.) **EQc5**: Option 1: Between 300 lux and 3,000 lux for at least 50% of the regularly occupied floor area (2 pts.) Option 2: 50% of all regularly occupied floor area must meet two of four kinds of views outlined in the Reference Guide (2 pts.)
What standards or tools are required for	N/A		N/A
Environmental Tobacco Smoke Control			
Does the metric help a building meet a current Federal Requirement?	Prohibit smoking within the building and within 25 feet of all building entrances, operable windows, and building ventilation intakes.	●	**Summary:** LEED v4 EB meets the Federal Requirement. **Environmental Tobacco Smoke Control (EQ Prerequisite 2)** Prohibit smoking in the building. Prohibit smoking outside the building except in designated smoking areas located at least 25 feet from all building openings (entries, outdoor air intakes, and operable windows).
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		Compliance
What standards or tools are required for	N/A		N/A
Moisture Control			

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Provide policy and illustrate the use of an appropriate moisture control strategy to prevent building damage, minimize mold contamination, and reduce health risks related to moisture. For façade renovations, Dew Point analysis and a plan for cleanup or infiltration of moisture into building materials are required.	◑	**Summary:** The LEED v4 EB credits listed below (Indoor Air Quality Management Program (EQ Credit 1), Thermal Comfort (EQ Credit 3), and Facility Maintenance and Renovation Policy (MR Prerequisite2)) are related to but not directly aligned with the Federal Requirements. LEED v4 EB does not address Dew Point analysis or give specific instructions for facade renovations. **Indoor Air Quality Management Program (EQ Credit 1)** Develop and implement an indoor air quality (IAQ) management program based on the EPA Indoor Air Quality Building Education and Assessment Model (I-BEAM). The I-BEAM audit requires an inspection of indoor spaces, HVAC systems, and the building exterior for IAQ issues (including moisture and mold). The credit also requires the development of a plan for resolving the IAQ issues identified. **Thermal Comfort (EQ Credit 3)** Have in place a system for continuous tracking and optimization of systems that regulate indoor comfort and conditions (air temperature, radiant temperature, humidity, and air speed) in occupied spaces. Have a permanent monitoring system to ensure ongoing building performance to the desired comfort criteria, as specified by ASHRAE Standard 55–2010. This credit addresses moisture in the context of occupant comfort and does not address installed materials or ongoing maintenance/operations strategies for moisture control. **Facility Maintenance and Renovation Policy (MR Prerequisite 2)** Have in place a facility maintenance and renovation policy that includes guidelines for renovation and maintenance activities, including an indoor air quality policy. The IAQ policy must follow the recommended control measures of Sheet Metal and Air Conditioning National Contractors Association (SMACNA). This credit covers the protection of building materials used in maintenance and renovation activities prior to installation. It does not address installed materials or ongoing maintenance/operations strategies for moisture control.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		N/A
What standards or tools are required for the metric?	Dew Point		EPA Indoor Air Quality Building Education and Assessment Model (I-BEAM), ASHRAE 55-2010, ISO 7730-2005 Ergonomics of the thermal environment, analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, European Standard EN 15251:2007, indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, Section A2, Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3)

Low Emitting Materials

Indoor Environment

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Use low-emitting materials for building modifications, maintenance, and cleaning. In particular, specify the following materials and products to have low pollutant emissions: composite wood products, adhesives, sealants, interior paints and finishes, solvents, carpet systems, janitorial supplies, and furnishings.	◑	**Summary:** LEED v4 EB is related to but not directly aligned with the Federal Requirements. Achieving LEED v4 EB Purchasing—Facility Maintenance and Renovation (MR Credit 3) does not necessarily meet the Federal Requirement, which can be achieved by purchasing products that do not meet low emitting requirements, but are considered environmentally preferred per other sustainability criteria outlined by LEED v4 EB. However, LEED v4 EB does meet the requirements for janitorial supplies. LEED v4 EB does not address solvents. **Purchasing—Facility Maintenance and Renovation (MR Credit 2) (1 pt.)** Purchase maintenance and renovation materials that meet at least one of the applicable sustainability criteria listed in the Reference Guide. Low emissions of volatile organic compounds and low emissions of formaldehyde are two criteria available under this credit. **Green Cleaning—Products and Materials (EQ Credit 7)** Purchase green cleaning materials and products such as floor finishes and strippers, disposable janitorial paper products, and trash bags.
What is the baseline or point of comparison?	N/A		**MRc2:** Total cost of maintenance and renovation materials **EQc7:** Total cost of cleaning products and materials
What is the range of requirements to achieve the metric?	N/A		**MRc2:** Purchase 50% compliant maintenance and renovation materials by cost (1 pt.) **EQc7:** Purchase 75% compliant cleaning products and materials by cost (1 pt.)
What standards or tools are required for	N/A		N/A
Acoustics (Not in GP)			
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies acoustics as an element of indoor environmental quality to be considered during the certification system review.	◕	**Summary:** If the LEED v4 EB credit is achieved, then the project will meet the Federal Requirement pertaining to the promotion of acoustics. **Occupant Comfort Survey (EQ Credit 10) (1 pt.)** Requires the administration of an occupant survey that assesses acoustics, building cleanliness, indoor air quality, lighting, and thermal comfort, at minimum. Corrective action planning must be undertaken when more than 20% occupants express dissatisfaction with comfort issues.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		Corrective action if 20% or more of the occupants express dissatisfaction with comfort.
What standards or tools are required for	N/A		N/A

Materials

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Recycled Content			
Does the metric help a building meet a current Federal Requirement?	Per section 6002 of RCRA, for EPA-designated products, use products meeting or exceeding EPA's recycled content recommendations for building modifications, maintenance, and cleaning. For other products, use materials with recycled content such that the sum of postconsumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost or weight) of the total value of the materials in the project. If EPA-designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building. EPA's recycled content product designations and recycled content recommendations are available on EPA's Comprehensive Procurement Guideline web site at <www.epa.gov/cpg>.	◑	**Summary:** LEED v4 EB is related to but does not directly align with the Federal Requirements. While EPA-designated products are an option to contribute to the LEED v4 EB credits listed below, achieving the credits do not necessarily meet the Federal Requirement. Some of the credits can be achieved by purchasing products that may be EPA-designated, but do not meet EPA's recycled content recommendations. **Site Management (SS Credit 5) (1 pt.)** Implement environmentally sensitive site management practices. Use of environmentally preferred fertilizers and use of organic waste generated on site (e.g., grass clippings, compost) over traditional fertilizers. **Purchasing—Ongoing (MR Credit 1) (1pt.)** Purchase ongoing consumables that meet at least one of the applicable sustainability criteria listed in the Reference Guide, including extended use, sustainable agriculture, bio-based materials, and FSC certified paper and wood products. Postconsumer recycled content is one criterion available under this credit and for EPA-designated products, the recycled content must exceed EPA recommendations. **Purchasing—Facility Maintenance and Renovation (MR Credit 2) (2 pt.)** Option 1: Purchase maintenance and renovation materials that meet at least one of the applicable sustainability criteria listed in the Reference Guide. Recycled content is one criterion available under this option and does not require meeting the EPA's recommended level or recycled content for EPA-designated products. Option 2: Purchase furniture that meets at least one of the applicable sustainability criteria listed in the Reference Guide. Recycled content is one criterion available under this option and does not require meeting the EPA's recommended level or recycled content for EPA-designated products. **Green Cleaning—Products and Materials (EQ Credit 7) (1 pt.)** Purchase green cleaning materials and products such as floor finishes and strippers, disposable janitorial paper products, and trash bags. Recycled content is one criterion available under this credit.
What is the baseline or point of comparison?	N/A		**SSc5:** Total cost or quantity (weight or volume) of fertilizer used **MRc1:** Total cost of ongoing consumables **MRc2:** Option 1: Total cost of maintenance and renovation materials Option 2: Total cost of furniture **EQc7:** Total cost of cleaning products and materials

Materials

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the range of requirements to achieve the metric?	N/A		**SSc5:** Use 100% compliant fertilizer by cost or quantity (1 pt.) **MRc1:** Purchase 60% compliant ongoing products by cost (1 pt. if durable goods threshold is also achieved) **MRc2:** Option 1: Purchase 50% compliant maintenance and renovation materials by cost (1 pt.) Option 2: Purchase 75% compliant furniture by cost (1 pt.) **EQc7:** Purchase 75% compliant cleaning products and materials by cost (1 pt.)
What standards or tools are required for the metric?	EPA's Comprehensive Procurement Guideline		N/A
Bio-based Content			
Does the metric help a building meet a current Federal Requirement?	Per section 9002 of FSRIA, for USDA-designated products, use products with the highest content level per USDA's bio-based content recommendations. For other products, use bio-based products made from rapidly renewable resources and certified sustainable wood products. If these designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them should be included in all solicitations relevant to construction, operation, maintenance of or use in the building. USDA's bio-based product designations and bio-based content recommendations are available on USDA's BioPreferred web site at <www.usda.gov/biopreferred>.	◑	**Summary:** LEED v4 EB is related to but not directly aligned with the Federal Requirements. Achieving the LEED v4 credits does not meet the Federal Requirement because LEED v4 EB does not recognize USDA's BioPreferred program. The credits can be achieved by purchasing products that are on the USDA-designated product list, but are not bio-based, if they are considered environmentally preferred per other sustainability criteria outlined by LEED v4 EB. **Purchasing—Ongoing (MR Credit 1) (1 pt.)** Purchase ongoing consumables that meet at least one of the applicable sustainability criteria listed in the Reference Guide. Bio-based content is one criterion available under this credit, but does not reference USDA-designated products or requirement that high bio-based content be specified for applicable products. **Purchasing—Facility Maintenance and Renovation (MR Credit 2) (1 pt.)** Option 1: Purchase maintenance and renovation materials that meet at least one of the applicable sustainability criteria listed in the Reference Guide. Bio-based content is one criterion available under this credit. Option 1: Purchase furniture that meets at least one of the applicable sustainability criteria listed in the Reference Guide. Bio-based content is one criterion available under this credit. **Green Cleaning—Products and Materials (EQ Credit 7) (1 pt.)** Purchase green cleaning materials and products such as floor finishes and strippers, disposable janitorial paper products, and trash bags. Sustainable forest products are one criterion available under this credit (Forest Stewardship Council certified janitorial paper products) Products that are USDA-designated need not have bio-based content in them to achieve this credit.

Materials

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the baseline or point of comparison?	N/A		**MRc1:** Total cost of ongoing consumables **MRc2:** Option 1: Total cost of maintenance and renovation materials Option 2: Total cost of furniture **EQc7:** Total cost of cleaning products and materials
What is the range of requirements to achieve the metric?	N/A		**MRc1:** Purchase 60% compliant ongoing products by cost (1 pt. if durable goods threshold is also achieved) **MRc2:** Option 1: Purchase 50% compliant maintenance and renovation materials by cost (1 pt.) Option 2: Purchase 75% compliant furniture by cost (1 pt.) **EQc7:** Purchase 75% compliant cleaning products and materials by cost (1 pt.)
What standards or tools are required for the	USDA's BioPreferred web site		N/A

Environmentally Preferable Products

Materials

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Use products that have a lesser or reduced effect on human health and the environment over their lifecycle when compared with competing products or services that serve the same purpose. A number of standards and ecolabels are available in the marketplace to assist specifiers in making environmentally preferable decisions. For recommendations, consult the Federal Green Construction Guide for Specifiers at <www.wbdg.org/design/greenspec.php>.		**Summary:** If LEED v4 EB Purchasing—Ongoing (MR Credit 1) and Purchasing—Facility Maintenance and Renovation (MR Credit 3) are achieved, then the project will meet the Federal Requirements. **Purchasing—Ongoing (MR Credit 1) (1 pt.)** Purchase ongoing consumables that meet at least one of the applicable sustainability criteria listed in the Reference Guide. The available criteria for ongoing consumables are the following: - Postconsumer recycled content - Extended use - Sustainable agriculture - Local sourcing of food and beverages - Bio-based materials - Paper and wood products certified by the Forest Stewardship Council The available criteria for durable goods are the following: - Electronic Product Environmental Assessment Tool (EPEAT) rating of silver or better - ENERGY STAR rating **Purchasing—Facility Maintenance and Renovation (MR Credit 2) (1 pt.)** Option 1: Purchase maintenance and renovation materials that meet at least one of the applicable sustainability criteria listed in the Reference Guide. The available criteria for maintenance and renovation materials are the following: - Recycled content - Wood products certified by the Forest Stewardship Council - Bio-based materials - Materials reuse - Extended producer responsibility - GreenScreen v1.2 Benchmark - Cradle to Cradle certified - Product manufacturer supply chain optimization - Low emissions of volatile organic compounds - Low emissions of formaldehyde Option 2: Purchase furniture that meets at least one of the applicable sustainability criteria listed in the Reference Guide. The available criteria for furniture are the same as maintenance and renovation materials (listed above), with the exception of low emissions of formaldehyde.
What is the baseline or point of comparison?	N/A		**MRc1:** Total cost of ongoing consumables **MRc2:** Option 1: Total cost of maintenance and renovation materials Option 2: Total cost of furniture
What is the range of requirements to achieve the metric?	N/A		**MRc1:** Purchase 60% compliant ongoing products by cost (1 pt. if durable goods threshold is also achieved) **MRc2:** Option 1: Purchase 50% compliant maintenance and renovation materials by cost (1 pt.) Option 2: Purchase 75% compliant furniture by cost (1 pt.)

Materials

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What standards or tools are required for the metric?	Federal Green Construction Guide		N/A
Waste and Materials Management			
Does the metric help a building meet a current Federal Requirement?	Provide reuse and recycling services for building occupants, where markets or on-site recycling exist. Provide salvage, reuse and recycling services for waste generated from building operations, maintenance, repair and minor renovations, and discarded furnishings, equipment and property. This could include such things as beverage containers and paper from building occupants, batteries, toner cartridges, outdated computers from an equipment update, and construction materials from a minor renovation.		**Summary:** LEED v4 EB is related to but does not align with the Federal Requirements. LEED v4 EB Ongoing Purchasing and Waste Policy (MR Prerequisite 1) addresses recycling of discarded furnishings, equipment, and property, and Facility Maintenance and Renovation Policy (MR Prerequisite 2) addresses recycling of building operations, maintenance and repairs per the Federal Requirements. However, LEED v4 EB does not require the provision of salvage or reuse services, although these can be used to achieve these credits. **Ongoing Purchasing and Waste Policy (MR Prerequisite 1)** The waste policy component of this prerequisite requires that projects establish storage locations for recyclable materials and have a solid waste management policy in place that addresses: - Ongoing waste (the five most purchased product categories based on total annual purchases) - Durable goods waste (office equipment, appliances, and audiovisual equipment, and electric powered equipment) - Hazardous waste (batteries and lamps) **Facility Maintenance and Renovations Policy (MR Prerequisite 2)** The waste policy component of this prerequisite requires that projects have a waste management policy that addresses: - Facility maintenance waste - Renovation waste (specific to each renovation project) **Solid Waste Management—Ongoing (MR Credit 4) (2 pts.)** Have a waste reduction and recycling program that reuses, recycles, or composts the following: - Ongoing waste as specified in MRp1 - Durable goods waste as specified in MRp1 - All discarded batteries - All mercury-containing lamps. **Solid Waste Management—Facility Maintenance and Renovation (MR Credit 5) (2 pts.)** Divert waste generated by facility maintenance and renovation activities from disposal in landfills and incinerators. Include base building elements as specified in Facility Maintenance and Renovation Policy (MR Prerequisite 2).
What is the baseline or point of comparison?	N/A		**MRp1:** N/A **MRp2:** N/A **MRc4:** Total waste generated, by waste category (ongoing, durable goods, batteries, and mercury-containing lamps) by weight or volume **MRc5:** Total waste generated for maintenance and renovations, by weight or volume

Materials

Review Questions	Federal Requirements (EB)		LEED v4 O+M: Existing Buildings (2014 Update)
What is the range of requirements to achieve the metric?	N/A		**MRp1: Compliance** **MRp2: Compliance** **MRc4:** Divert 50% of ongoing waste, divert 75% of durable goods waste by weight or volume, divert 100% of batteries and mercury-containing light bulbs (all by weight or volume) (2 pts.) **MRc5:** Divert 70% of facility maintenance and renovation waste by weight or volume (2 pts.)
What standards or tools are required for the	N/A		Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3)
Ozone Depleting Compounds			
Does the metric help a building meet a current Federal Requirement?	Eliminate the use of ozone depleting compounds where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account lifecycle impacts.	◑	Summary: LEED v4 EB is related to but not directly aligned with the Federal Requirements. LEED v4 EB Fundamental Refrigerant Management (EA Prerequisite 4) supports the Federal Requirements by restricting the use of CFCs. Enhanced Refrigerant Management (EA Credit 8) requires a minimization or elimination of refrigeration compounds that contribute to ozone depletion and climate change. It is possible to achieve the prerequisite and credit without eliminating ozone depleting compounds as described in the Federal Requirements. In addition, LEED v4 EB only addresses refrigerants, rather than all product types addressed in the Montreal Protocol and referred to as EPP in the Federal Requirements. Fundamental Refrigerant Management (EA Prerequisite 4) Do not use CFC-based refrigerants in heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems. Or, if CFCs are in use, a third-party audit must show that system replacement or conversion is not economically feasible, or implement a CFC phase-out plan. Phase-out plans should be scheduled for completion within 10 years. Enhanced Refrigerant Management (EA Credit 8) (1 pt.) Option 1: Do not use refrigerants, or use only refrigerants that have an ozone depleting potential of zero and a global warming potential of less than 50. Option 2: Use refrigerants with lower ozone depleting potentials and global warming potentials to encourage early compliance with the Montreal Protocol. Compliance is determined by a refrigerant impact calculation.
What is the baseline or point of comparison?	Zero ozone depleting compounds		**EAp4:** Zero CFC-based refrigerants **EAc8:** Total refrigerant impact per ton
What is the range of requirements to achieve the metric?	Zero ozone depleting compounds		**EAp4:** Compliance **EAc8:** Less than or equal to 100 (1 pt.)
What standards or tools are required for the	Montreal Protocol and Title VI of the Clean Air Act Amendments of		U.S. EPA Clean Air Act, Title VI, Section 608, Refrigerant Recycling Rule

Appendix D: LEED v. 4 EB Conformance Methods: Measured, Calculated and Evidence of Intent

MCI Assessment:
LEED v4 O+M: Existing Buildings (LEED EB)

M=Measured Performance
C=Calculated Performance
I=Evidence of Intent

GP	Guiding Principles Existing Buildings	LEED v4 EB
Robustness – Integrated Principles		
N/A	Integrated Assessment, Operation and Management	I/C/M
M	Commissioning	M
I	Building System Controls (Not in GP)	I/C/M
I	Siting (Not in GP)	I/M
I/C	Greenhouse Gas (Not in GP)	I/M
Comments: Integrated Assessment, Operation and Management contains elements that are both C and M in LEED OM. Meters are considered to meet the Federal Requirement for Building System Controls and are installed in LEED OM projects. Greenhouse Gas is considered C/M because a wide variety of strategies that are both C and M were identified in the Robustness table as supporting the Federal Requirement.		
Energy		
I/C/M	Energy Efficiency	I/C/M
I/C	On-Site Renewable Energy and Green Power	M
I/M	Measurement and Verification	I/M
M	Benchmarking	C/M
N/A	Use ENERGY STAR, FEMP or EPEAT Products	I
Comments: ENERGY STAR and FEMP products are I because the requirement for ENERGY STAR products needs to be included in plans for ongoing operations. Consider, however, that FEMP products are not required (N/A). Install meters is considered M because meters are installed in the project.		
Water		
C/M	Indoor Water	C/M

Appendix D: LEED v. 4 EB Conformance Methods: Measured, Calculated and Evidence of Intent

I	Process Water	C/M
C/M	Outdoor Water	C/M
I/M	Measurement of Water Use	I/M
C	Stormwater	I/C
I	Water-Efficient Products	I/C/M

Comments:
The installation of water meters for indoor and outdoor water use are M because they are required to be installed.

Cooling tower process water is addressed by measuring concentration parameters in the water and adjusting the cooling tower cycles accordingly.

WaterSense products need to be part of a water policy that addresses future renovations and as such, are considered Intent. Water calculations are based on installed fixtures whether they are WaterSense or not.

Certified irrigation system installers are not required for any credit in LEED.

Stormwater volumes are calculated.

Requirements to incorporate best practices in site management and improvement plans are considered I.

Resources/Materials		
I/C	Recycled Content	I/M
I	Bio-based Content	I/M
I	Environmentally Preferable Products	I/M
I	Waste and Materials Management	I/M
I/M	Ozone Depleting Compounds	I/C

Comments:
Recycled content, biobased content, environmentally preferable materials in plans for ongoing operations (I), and product purchases are also measured during the performance period (M).

Construction waste management is calculated according to weight or volume.

LEED v4 provides a calculated approach in the case that ozone depleting compounds are not fully eliminated.

Indoor Environment		
C	Ventilation	I/C
C	Thermal Comfort	C/M

Appendix D: LEED v. 4 EB Conformance Methods: Measured, Calculated and Evidence of Intent

I	Integrated Pest Management	I/M
I/C/M	Daylighting & Lighting Controls	I/C/M
I	Environmental Tobacco Smoke Control	I
I/C/M	Moisture Control	I/M
I	Low-Emitting Materials	I/M
I	Acoustics (Not in GP)	M

Comments:
Low-emitting materials and integrated pest management are included in plans for ongoing operations (I), and are also measured through the performance period (M).

Acoustics are measured through occupant comfort surveys.

Appendix E: LEED v. 4 CI Robustness Review

Robustness Key (from section 4.9 of the 2012 Study)	
●	Full circles (green) mean that the Federal requirement would automatically be met if the building was certified because the system and Federal requirements fully align, and the requirement within the green building certification system is a prerequisite.
◕	Three-quarter circles (green) mean that the certification system has an option (e.g.., point, credit, etc.) that meets the Federal Requirement; if that option is included in the certification package, the Federal Requirement would be met.
◑	A half circle (yellow) means the certification system includes an option related to but not directly aligned with the Federal Requirement. The certification systems may have a lower standard, different baselines, different calculation methods, or different ways to document compliance with the Federal Requirement.
○	An empty circle means the Federal Requirement is not an identified component within the certification system.

NOTE: LEED v4 does not number credits in any of the LEED rating system reference guides. However, the USGBC published LEED v4 checklists do contain credit numbers. To facilitate the organization of content, the tables include credit numbers consistent with the nomenclature of the LEED v4 checklists and past LEED rating systems. system. This robustness table is primarily references Federal Requirements applicable to new construction as they are closely aligned with the LEED v4 CI rating system. Federal Requirements for existing buildings are used for energy efficiency and daylighting.

Integrative Principles

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Integrated Design			
Does the metric help a building meet a current Federal Requirement?	Integrated Design. Use a collaborative, integrated planning and design process that • Initiates and maintains an integrated project team as described on the Whole Building Design Guide <http://www.wbdg.org/design/engage_process.php> in all stages of a project's planning and delivery • Integrates the use of OMB's A-11, Section 7, Exhibit 300: Capital Asset Plan and Business Case Summary • Establishes performance goals for siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and ensures incorporation of these goals throughout the design and lifecycle of the building • Considers all stages of the building lifecycle, including deconstruction.	◑	**Summary:** LEED v4 CI contains two credits that are related to but not directly aligned with the Federal Requirements. The Federal Requirements mandate specific processes and activities for integrated design. The LEED v4 CI Integrative Process (IP Credit 1) gives specific guidelines for how analysis should be used to inform decision making. While this supports the Federal Requirement to ensure incorporation of performance goals throughout the design and lifecycle of the building, the Federal Requirements contain additional and specific requirements including the establishment of performance goals for siting, materials and indoor environmental quality, and lifecycle considerations that are not addressed in the credit. LEED v4 CI credit LEED Accredited Professional (IN Credit 2) lists an intent "to encourage the team integration required by a LEED project and to streamline the application and certification process." While aligned with the Federal Requirement for an integrated project team, there are no specific performance requirements for the LEED AP to engage an integrated project team. Neither of the credits require the integration of OMB's Capital Asset Planning and Business Case Summary process into the OPR and BOD. **Integrative Process (IP Credit 1)** Requires the use of analysis to set goals and strategies and inform the Owner's Project Requirements (OPR) document, basis of design (BOD), and design and construction documents. Preliminary energy modeling analysis as well as a water budget analysis are required to set the project on the right path by providing initial feedback on performance to the integrated design team. **LEED Accredited Professional (IN Credit 2)** Awards credit to the project for the participation of a LEED Accredited Professional with a specialty appropriate to the project.
Does the certification system help users achieve cost saving	N/A		The involvement of the LEED AP and associated resources available to project teams are intended to support integrated credit achievement through more integrative thinking and design practices, thereby creating an opportunity for cost-savings.
What is the baseline or point of comparison?	N/A		N/A

Integrative Principles

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
What is the range of requirements to achieve the metric?	N/A		N/A
What standards or tools are required for	N/A		N/A
Commissioning			
Does the metric help a building meet a current Federal Requirement?	Employ commissioning practices tailored to the size and complexity of the building and its system components in order to verify performance of building components and systems and help ensure that design requirements are met. This should include an experienced commissioning provider, inclusion of commissioning requirements in construction documents, a commissioning plan, verification of the installation and performance of systems to be commissioned, and a commissioning report.	●	**Summary:** LEED v4 CI meets the intent of the Federal Requirements. **Fundamental Commissioning and Verification (EA Prerequisite 1)** Requires the commissioning of mechanical, electrical, plumbing, and renewable energy systems and assemblies, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 by a qualified commissioning authority. The prerequisite also requires that an operations and maintenance plan be developed for ongoing operations. **Enhanced Commissioning (EA Credit 1)** Projects can earn 4 or 5 points for various levels of commissioning. Option 1: Enhanced Systems Commissioning (4 pts.) includes additional reviews and verifications, a post-occupancy review, and ongoing commissioning plan. Option 2: Monitoring-Based Commissioning (5 pts.) includes the development of monitoring-based procedures for energy and water systems.
What is the baseline or point of comparison?	N/A		
What is the range of requirements to achieve the metric?	N/A		
What standards or tools are required for	N/A		ASHRAE Guideline 0-2005, ASHRAE Guideline 1.1-2007
Building System Controls (Not in GP)			

Integrative Principles

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies building system controls as an element of indoor environmental quality to be considered during the certification system review.	◑	**Summary:** LEED v4 CI is related to but does not directly align with the Federal Requirement for building system controls (building automation system). Advanced energy metering can play an important role in a BAS, but does not provide the level of control needed to meet the intent of the requirement. Similarly, mechanical systems designed to maintain comfort within the parameters of ASHRAE 55-2010 provide some building level comfort management, but do not singularly constitute building system controls. There is no requirement for building automation systems in LEED v4 CI. **Advanced Energy Metering (EA Credit 3) (1-2 pts.)** Option 1: Metering (1 pt.) Requires tenant-level energy meters are installed (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc.) All data needs to be shared with the USGBC for a period of 5 years. The USGBC works to reduce disparities between predictive and actual performance by analyzing data and sharing results. Option 2. Advanced Metering (2 pts.) Install advanced energy metering for energy end uses that represent 10% or more of the tenant space energy consumption and comply with specific requirements. The data collection system for the advanced metering must use a local area network, building automation system, wireless network, or comparable communication infrastructure. **Thermal Comfort (EQ Credit 5) (1 pt.)** To achieve the credit, projects must be designed to ASHRAE 55-2010 Standard. In addition, LEED v4 CI has combined requirements for controllability of systems with this credit to enhance occupant comfort and well-being. In addition, individual thermal comfort controls need to be provided to at least 50% of individual occupants and also in multioccupant spaces. This credit addresses moisture in the context of occupant comfort and does not address installed materials or ongoing maintenance/operations strategies for moisture control.
What is the baseline or point of comparison?	N/A		**EAc3:** N/A **EQc5:** ASHRAE 55-2010
What is the range of requirements to achieve the metric?	N/A		**EAc3:** Compliance **EQc5:** Option 1: Compliance Option 2: Controls for 50% of occupants
What standards or tools are required for the metric?	N/A		ASHRAE 55-2010, ISO 7730-2005 Ergonomics of the thermal environment, analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, European Standard EN 15251:2007, indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics, Section A2
Siting (Not in GP)			

Integrative Principles

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies reduced impacts from transportation through building location and site design that promote access by public transportation as an element of indoor environmental quality to be considered during the certification system review.	◕	**Summary**: If either LEED v4 CI Surrounding Density and Diverse Uses (LT Credit 4) or Access to Quality Transit (LT Credit 5) are achieved, the project will meet the Federal Requirement by promoting reduced impacts from transportation through building location and site design that promotes assess by public transit. In addition, Bicycle Facilities (LT Credit 6) and Reduced Parking Footprint (LT Credit 7) are related as they support the use of alternative transportation. **Surrounding Density and Diverse Uses (LT Credit 2) (1-8 pts.)** Option 1: (3-6 pts.) Locate the project on a site with a surrounding density that exceeds stated values; 22,000 square feet per acre of buildable land (3 pts.) or 35,000 square feet per acre of buildable land (6 pts.) Option 2: (1-2 pts.) Construct or renovate the project within a building that is located within a 1/2 mile of 4-7 (1 pt.) or 8 or more (2 pts.) diverse uses. **Access to Quality Transit (LT Credit 3) (1-7 pts.)** Locate the project within 1/4 mile of bus, streetcar or rideshare stops, or within a 1/2 mile of bus rapid transit, rail or commuter ferry terminals. Points are awarded based on minimum numbers of weekday and weekend trips.
What is the baseline or point of comparison?	N/A		**LTc2:** Option 1: N/A Option 2: N/A **LTc3:** N/A
What is the range of requirements to achieve the metric?	N/A		**LTc2:** Option 1: 22,000 or 35,000 sf per acre of building land (3-6 pts.) Option 2: proximity of 4 or more diverse uses (1-2 pts.) **LTc3:** proximity to transportation options (1-7 pts.)
What standards or tools are required for the metric?	N/A		N/A

Greenhouse Gas (Not in GP)

Integrative Principles

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	E.O. 13423 and 13514 establish specific targets for agencies in building design, construction and operations in the areas of energy use, water use, greenhouse gas emissions, waste reduction, stormwater management, and facility siting. E.O. 13514 also requires reductions in greenhouse gas emissions.	●	**Summary:** Federal Requirements for Greenhouse Gas emissions pertain to agency-wide goals. As such, they do not have project-specific requirements. LEED v4 CI Minimum Energy Performance (EA Prerequisite 2) contributes to the Federal Goals for every project that pursues LEEDv4 CI. Additionally, Optimize Energy Performance (EA Credit 2), Renewable Energy Production (EA Credit 4), and Green Power and Carbon Offsets (EA Credit 6) are all related to the reduction of greenhouse gas emissions and represent the spectrum of opportunity for reducing GHG emissions through new construction projects. **Minimum Energy Performance (EA Prerequisite 2)** Projects must achieve a 3% reduction as compared against the ASHRAE 90.1-2010 baseline. The prerequisite also allows a prescriptive compliance path that requires mandatory and prescriptive provisions of the ASHRAE 90.1-2010 baseline, a 5% reduction in lighting power density, and the use of ENERGY STAR eligible products. **Optimize Energy Performance (EA Credit 2) (1-25 pts.)** Option 1: Tenant-Level Energy Simulation (4-25 pts.) Improve performance between 4% and 28% as compared to the ASHRAE 90.1-2010 baseline. Option 2: Prescriptive Compliance (1-16 pts.) Comply with a combination of a variety of strategies including base building systems, HVAC systems, interior lighting and equipment and appliance. **Renewable Energy Production (EA Credit 4) (3 pts.)** Credit is awarded for the installation of 1%-5% of renewable energy on-site. Allowable sources of renewable energy include photovoltaic, solar thermal, wind, biofuel (in some cases), low-impact hydroelectricity, wave and tidal energy, and geothermal energy (in some cases). **Green Power and Carbon Offsets (EA Credit 6) (2 pts.)** Qualifying renewable energy credits or carbon offsets may be purchased for 50%-100% of project energy for 5 years to earn points. All RECs must have originated after January 1, 2005. The following LEED v4 CI credits also support the energy and transportation related reductions of GHG emissions in buildings. They are discussed throughout this document. **Surrounding Density and Diverse Uses (LT Credit 2) (1-8 pts.)** **Access to Quality Transit (LT Credit 3) (1-7 pts.)** **Bicycle Facilities (LT Credit 4) (1 pt.)** **Fundamental Refrigerant Management (EA Prerequisite 3)** **Enhanced Refrigerant Management (EA Credit 5) (1 pt.)** **Storage and Collection of Recyclables (MR Prerequisite 1)** **Construction and Demolition Waste Management Planning (MR Prerequisite 2)** **Interiors Life-Cycle Impact Reduction (MR Credit 2) (1-2 pts.)** **Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 3) (1-2 pts.)** **Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 4) (option 2) (1 pt.)** **Construction and Demolition Waste Management (MR Credit 6) (1-2 pts.)**
What is the baseline or point of comparison?			**EAp2:** ASHRAE 90.1-2010 **EAc2:** ASHRAE 90.1-2010 **EAc4:** Annual energy cost **EAc6:** Total project energy
What is the range of requirements to achieve the metric?	N/A		**EAp2:** Compliance **EAc2:** 6%-50% for new construction and 4%-48% for existing building renovations (1-20 pts.) **EAc4:** 1%-10% (1-3 pts.) **EAc6:** 50%-100% (1-2 pts.)

Integrative Principles

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
What standards or tools are required for	N/A		ANSI/ASHRAE/IESNA Standard 90.1-2010, Center for Resource Solutions Green-e Program, Commercial Building Energy Consumption Survey (CBECS)

Energy

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Energy Efficiency			
Does the metric help a building meet a current Federal Requirement?	The 2008 Guiding Principles Guidance for Existing Buildings outlines three strategies to achieve reduction of energy use at the facility level: achieve an Energy Star Portfolio Manager score of 75 or higher; reduce measured building energy use by 20% (relative to a defined baseline); or reduce modeled energy use 20% compared with ASHRAE 90.1-2007. If a Federal agency leases space in an existing building that has not earned the ENERGY STAR label, EISA requires that the building either (a) earn the ENERGY STAR label within one year of occupancy (or 18 months of occupancy in certain cases); or (b) implement conservation and energy efficiency improvements that are cost effective within the life of the lease.	◑	**Summary:** LEED v4 CI is related to but not directly aligned with the Federal Requirements. The Federal Requirement targets whole building energy use, a tenant improvement project can only impact those items within this CI scope. LEED V4 CI uses the updated ASHRAE 90.1-2010 Standard as the baseline. It is more stringent than the ASHRAE 90.1-2007 Standard referenced in the Federal Requirement. For portions of the building within the tenant's scope of work, a 3% reduction is required as part of Minimum Energy Performance (EA Prerequisite 2). Optimize Energy Performance (EA Credit 2) provides points to projects that earn up to a 28% reduction. Because the updated ASHRAE 90.1-2010 Standard is more stringent, it is likely that if enough points are earned in Optimize Energy Performance (EA Credit 2), the Federal Requirement will be met. An exact number of points that will be required to meet the Federal Requirement can not be determined because each tenant space will have a unique baseline model, based on ASHRAE 90.1-2010, from which energy reductions are achieved. Prescriptive compliance options in LEED v4 CI Minimum Energy Performance (EA Prerequisite 2) and Optimize Energy Performance (EA Credit 2) are related to, but not directly aligned with the Federal Requirement because they do not require a comparison to a baseline standard and instead rely on the implementation of best practices. A project would have to pursue the performance based options to meet pertinent Federal Requirements. LEED v4 CI does not require any explicit use or align with ENERGY STAR targets (note that ENERGY STAR certification is a metric for existing buildings with actual performance data). If the Federal Requirement is interpreted to mean using the Target Finder tool to develop future energy performance goals, then LEED v4 CI does not have this process requirement. There is no requirement in LEED v4 CI that requires whole buildings to engage in energy efficiency improvements as part of lease negotiations. **Minimum Energy Performance (EA Prerequisite 2)** Projects must achieve a 3% reduction as compared against the ASHRAE 90.1-2010 baseline. The prerequisite also allows a prescriptive compliance path that requires mandatory and prescriptive provisions of the ASHRAE 90.1-2010 baseline, a 5% reduction in lighting power density, and the use of ENERGY STAR eligible products. **Optimize Energy Performance (EA Credit 2) (1-25 pts.)** Option 1: Tenant-Level Energy Simulation (4-25 pts.) Improve performance between 4% and 28% as compared to the ASHRAE 90.1-2010 baseline. Option 2: Prescriptive Compliance (1-16 pts.) Comply with a combination of a variety of strategies including base building systems, HVAC systems, interior lighting and equipment and appliance.
What is the baseline or point of comparison?	ASHRAE 90.1-2007; Energy use in 2003		ANSI/ASHRAE/IESNA 90.1-2010
What is the range of requirements to achieve the metric?	30%; 20%		**EAp2:** 3% reduction **EAc2:** 4-28% (4-25 pts.)

Energy

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
What standards or tools are required for the metric?	ASHRAE 90.1-2007		ANSI/ASHRAE/IESNA Standard 90.1-2010
On-Site Renewable Energy & Green Power			
Does the metric help a building meet a current Federal Requirement?	Per the Energy Independence and Security Act (EISA) Section 523, meet at least 30% of the hot water demand through the installation of solar hot water heaters, when lifecycle cost effective. The 2013 Presidential Memorandum on Federal Leadership in Energy Management requires that agencies meet 20% of total electric energy consumption through renewable sources by fiscal year 2020. The Memorandum outlines acceptable renewable sources to include: * agency-funded renewable energy on-site with renewable energy certificate retained; * on-site or off-site renewable energy developed by contract, with renewable energy certificates retained for the contract's life; * purchasing electricity and corresponding renewable energy certificates; * purchasing renewable energy certificates. ``Renewable energy certificates'' means the technology and environmental (non-energy) attributes that represent proof that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource, and can be sold separately from the underlying generic electricity with which it is associated.	◑	**Summary:** LEED v4 CI is related to but not directly aligned with the Federal Requirements for on-Site Renewable Energy & Green Power. LEED v4 CI Renewable Energy Production (EA Credit 4) awards credit to projects that produce between 1%-5% of their energy requirement on-site. Renewable energy production is typically on-site, although LEED v4 CI allows for off-site owned or leased systems to be awarded credit if RECs are also acquired. These configurations of energy production, use, and REC retainment support the agency-wide Federal Requirements for points (i) and (ii). Similarly, the agency-wide Federal Requirements for points (iii) and (iv) address green power and both points are supported by Green Power and Carbon Offset (EA Credit 6) for Green Power and Carbon Offsets. LEED v4 CI requires all Green Power and Carbon Offsets to be Green-e certified. The Federal Requirements have no such qualifications. Because LEED v4 CI Renewable Energy Production (EA Credit 4) permits a range of applicable types of renewable energy including solar pv, tidal, wind, and geothermal, LEED v4 CI is related to but not directly aligned with the Federal Requirement for solar hot water. **Renewable Energy Production (EA Credit 4) (1-3 pts.)** Credit is awarded for the installation of 1%-5% of renewable energy on-site. Allowable sources of renewable energy include photovoltaic, solar thermal, wind, biofuel (in some cases), low-impact hydroelectricity, wave and tidal energy, and geothermal energy (in some cases). **Green Power and Carbon Offsets (EA Credit 6) (1-2 pts.)** Qualifying renewable energy credits or carbon offsets may be purchased for 50%-100% of project energy for 5 years to earn points.
What is the baseline or point of	N/A		Annual energy cost
What is the range of requirements to achieve the metric?	N/A		**EAc4:** Renewable Energy Production 1%-5% (1-3 pts.) **EAc6:** Green Power and Carbon Offsets 50%-100% (1-2 pts.)
What standards or tools are required for	N/A		Center for Resource Solutions Green-e Program, Commercial Building Energy Consumption Survey (CBECS)

Energy

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Is on-site generation and purchases of green power treated differently?	no		Yes. Renewable energy production is typically on-site although LEED v4 CI allows for off-site owned or leased systems to be awarded credit if RECs are also acquired. LEED v4 CI EA Credit 7 addresses green power and carbon offsets specifically.
Measurement and Verification			
Does the metric help a building meet a current Federal Requirement?	Per the Energy Policy Act of 2005 (EPAct) Section 103, install building level electricity meters in new major construction and renovation projects to track and continuously optimize performance. Per EISA Section 434, include equivalent meters for natural gas and steam, where natural gas and steam are used. The Presidential Memo on Energy Management (2013) requires agencies to install (where cost-effective and appropriate) building energy meters, energy sub-meters and water meters, and to enter metered data into the EPA ENERGY STAR Portfolio Management System to support benchmarking. Annual energy performance data will continue to be publicly disclosed through DOE's web-based tracking system.	◑	**Summary:** LEED v4 CI is related to but not directly aligned with the Federal Requirements. Advanced Energy Metering (EA Credit 3) aligns with the Federal Requirements for electricity, natural gas and steam meters, as well as tracking data. The Federal Requirement requires this information to be metered at the building level, whereas Advanced Energy Metering (EA Credit 3) requires meters to be installed at the tenant level. LEED v4 CI does not include provisions for water-metering and does not require reporting energy and water reporting in the EPA's ENERGY STAR Portfolio Manager (as this tool is designed for whole building energy and water use). If Advanced Energy Metering (EA Credit 3) is achieved, LEED v4 CI requires projects to report energy data to the USGBC for data aggregation and analysis, and the USGBC will accept data from a number of approved sources. Because of this, LEED v4 CI aligns with, but does not meet all of the Federal Requirements for Measurement and Verification. **Advanced Energy Metering (EA Credit 3) (1-2 pts.)** Option 1: Metering (1 pt.) Requires tenant-level energy meters are installed (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc.) All data needs to be shared with the USGBC for a period of 5 years. The USGBC works to reduce disparities between predictive and actual performance by analyzing data and sharing results. Option 2. Advanced Metering (2 pts.) Install advanced energy metering for energy end uses that represent 10% or more of the tenant space energy consumption and comply with specific requirements. The data collection system for the advanced metering must use a local area network, building automation system, wireless network, or comparable communication infrastructure.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		Compliance
What standards or tools are required for the metric?	EPAct 2005 Section 103; EISA Section 434		N/A
Benchmarking			

Energy

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Compare actual performance data from the first year of operation with the energy design target, preferably by using ENERGY STAR Portfolio Manager for building and space types covered by ENERGY STAR. Verify that the building performance meets or exceeds the design target, or that actual energy use is within 10% of the design energy budget for all other building types. For other building and space types, use an equivalent benchmarking tool such as the Labs21 benchmarking tool for laboratory buildings.	◑	**Summary:** LEED v4 CI related to but not directly aligned with the Federal Requirements for benchmarking. Both the Federal Requirements and LEED v4 CI Advanced Energy Metering (EA Credit 3) require projects to document post-occupancy energy use, but they use different baselines for benchmarking actual performance. LEED v4 CI relies on the USGBC to analyze data as opposed to the use of ENERGY STAR Portfolio Manager preferred by the Federal Requirements (note that Portfolio Manager is only applicable to whole building energy usage and is generally not applicable for tenant fit out projects). LEED v4 CI does not require that specific energy reduction goals be set as part of the tenant fit-out process, nor is there a requirement for the actual energy use to be verified to be within 10% of the predicted value. **Advanced Energy Metering (EA Credit 3) (1-2 pts.)** Option 1: Metering (1 pt.) Requires tenant-level energy meters are installed (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc.) All data needs to be shared with the USGBC for a period of 5 years. The USGBC works to reduce disparities between predictive and actual performance by analyzing data and sharing results. Option 2. Advanced Metering (2 pts.) Install advanced energy metering for energy end uses that represent 10% or more of the tenant space energy consumption and comply with specific requirements. The data collection system for the advanced metering must use a local area network, building automation system, wireless network, or comparable communication infrastructure.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		Compliance
What standards or tools are required for the metric?	ENERGY STAR		N/A

Water

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Indoor Water			
Does the metric help a building meet a current Federal Requirement?	Employ strategies that in aggregate use a minimum of 20% less potable water than the indoor water use baseline calculated for the building, after meeting the EPAct 1992, Uniform Plumbing Codes 2006, and the International Plumbing Codes 2006 fixture performance requirements. The installation of water meters is encouraged to allow for the management of water use during occupancy. The use of harvested rainwater, treated wastewater, and air conditioner condensate should also be considered and used where feasible for non-potable use and potable use where allowed.	●	**Summary:** LEED v4 CI meets the Federal Requirements for 20% water reductions through fixture efficiency in Indoor Water Use Reduction (WE Prerequisite 1). Reductions greater than 20% (using fixture efficiency or alternative water technologies) will be awarded credit as part of Indoor Water Use Reduction (WE Credit 1), as are the use of non-potable / alternative sources of water and water reuse. **Indoor Water Use Reduction (WE Prerequisite 1) (20%)** LEED v4 CI meets the Federal Requirements for 20% water reductions through fixture efficiency in WE Prerequisite 1. Reductions greater than 20% (using fixture efficiency or alternative water technologies) will be awarded credit as part of WE Credit 1, as are the use of non-potable / alternative sources of water and water reuse. Projects where fixtures or fixture fittings are not within the tenant spaces can be excused from this LEED v4 CI prerequisite requirement. **Indoor Water Use Reduction (WE Credit 1) (25%-50%) (2-12 pts.)** Credit recognizes reductions from 25-50% and expands the requirement for appliance and process water use reductions. Once 20% water reductions are achieved through efficiency as part of the prerequisite, additional reductions may be achieved through fixture efficiency or through the use of alternative water sources (water harvesting for reuse). WE Credit 1 provides additional credit for indoor water fixture reductions from 25-50%. Once 20% water reduction is achieved through efficiency as part of the prerequisite, additional reductions may be achieved through fixture efficiency or through the use of alternative water sources (e.g. water harvesting for reuse). For projects where fixtures or fixture fittings are not within the tenant spaces, the closest washrooms must be included in the credit calculations.
What is the baseline or point of	EPAct 1992 and 2005, UPC/IPC 2006		WEp1: Based on EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements WEc1: Based on EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements
What is the range of requirements to achieve the metric?	20%		**WEp1:** 20% **WEc1:** 25%, 30%, 35%, 40%, 45%, 50% (2-12 pts.)
What standards or tools are required for the metric?	EPAct 1992 and 2005, UPC/IPC 2006		Water Use Calculator provided by USGBC
Process Water			

Water

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Per the Energy Policy Act of 2005 Section 109, when potable water is used to improve a building's energy efficiency, deploy lifecycle cost effective water conservation measures.	●	**Summary:** LEED v4 CI Indoor Water Use Reduction (WE Prerequisite 1) meets the Federal Requirement for projects in which identified process water reductions are within the scope. **Indoor Water Use Reduction (WE Prerequisite 1) (20%)** LEED v4 CI meets the Federal Requirements for 20% water reductions through fixture efficiency in WE Prerequisite 1. Reductions greater than 20% (using fixture efficiency or alternative water technologies) will be awarded credit as part of WE Credit 1, as are the use of non-potable / alternative sources of water and water reuse. In addition, projects must meet requirements for process water reductions including uses such as clothes washers, dishwashers, ice machines, heat rejection and cooling, and cooling towers and evaporative condensers. Projects where fixtures or fixture fittings are not within the tenant spaces are exempt from this prerequisite.
What is the baseline or point of			**WEp1:** Based on EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements
What is the range of requirements to achieve the metric?			**WEp1:** 20%
What standards or tools are required for the metric?			Water Use Calculator provided by USGBC
Water-Efficient Products			
Does the metric help a building meet a current Federal Requirement?	Specify EPA's WaterSense-labeled products or other water conserving products, where available. Choose irrigation contractors who are certified through a WaterSense labeled program.	●	**Summary:** LEED v4 CI aligns with the Federal Requirement for WaterSense-labeled products or other water conserving products. Irrigation is not relevant to leases. **Indoor Water Use Reduction (WE Prerequisite 1)** The prerequisite requires that "all newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled."
What is the baseline	N/A		**WEp1:** Based on EPA WaterSense, EPAct 1992 and 2005, UPC/IPC 2006, plus additional requirements
What is the range of requirements to achieve the metric?	N/A		**WEp1:** 20%
What standards or tools are required for the metric?	EPA WaterSense or equivalent		Water Use Calculator provided by USGBC

Indoor Environment

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Ventilation			
Does the metric help a building meet a current Federal Requirement?	Meet ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone, and ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality.	●	**Summary:** LEED v4 CI Minimum Indoor Air Quality Performance (EQ Prerequisite 1), System Able to Meet Required Outdoor Airflow Rates (Case 1), Meet the minimum requirements of ASHRAE 62.1-2010, Sections 4-7, Ventilation for Acceptable Indoor Air Quality, or a local equivalent, whichever is more stringent (Option 1), meets the Federal Requirements for ventilation (providing adequate fresh air for occupants), referencing ASHRAE Standard 62.1. LEED v4 CI Minimum Indoor Air Quality Performance (EQ Prerequisite 1) references the updated and more stringent version of the standard, ASHRAE 62.1-2010, whereas the Federal Requirements specify the 2007 version. If the tenant space has systems constraints, it may not meet the Federal Requirement. Minimum Indoor Air Quality Performance (EQ Prerequisite 1) Systems Unable to Meet Required Outdoor Airflow Rates (Case 2) can be considered best practice for tenant spaces that are unable to meet the requirement because of system constraints. The Federal Requirement for thermal comfort (control for temperature, humidity, air speed, radiative heating and cooling) is addressed by a separate LEED v4 CI credit and the ASHRAE Standard 55-2004, and is discussed in the next section. The full circle rating is for ventilation only. **Minimum Indoor Air Quality Performance (EQ Prerequisite 1)** Case 1: System Able to Meet Required Outdoor Airflow Rates Option 1: Meet the minimum requirements of ASHRAE 62.1-2010, Sections 4-7, Ventilation for Acceptable Indoor Air Quality, or a local equivalent, whichever is more stringent. Case 2: Systems Unable to Meet Required Outdoor Airflow Rates If meeting the outdoor airflow rate is not possible due to building system constraints, conduct an assessment of the maximum outdoor air delivery rate. Supply the maximum possible to each the minimum setpoint in Case 1 and not less than 10 cubic feet per minute of outdoor air per person. **Enhanced Indoor Air Quality Strategies (EQ Credit 1) (1-2 pts.)** Option 1: Enhanced IAQ Strategies (1 pt.) Includes requirements such as entryway systems, interior cross-contamination prevention and filtration depending on the ventilation system. Option 2:Additional Enhanced IAQ Strategies (1 pt.) Includes additional strategies depending on the ventilation system.
What is the baseline or point of comparison?			**EQ p1:** Case 1, Option 1: ASHRAE 62.1--2010 Case 2: N/A **EQ c1:** Option 1: N/A Option 2: N/A
What is the range of requirements to achieve the metric?			**EQp1:** Case 1, Option 1: Compliance Case 2: Compliance **EQc1:** Option 1: Compliance (1 pt.) Option 2: Compliance (1 pt.)

Indoor Environment

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
What standards or tools are required for the metric?	ASHRAE Standard 62.1-2007 and portions of ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy		ASHRAE 62.1-2010, or local equivalent, CIBSE Applications Manual AM10, March 2005
Thermal Comfort			
Does the metric help a building meet a current Federal Requirement?	Meet ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone, and ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality.		**Summary:** Achieving LEED v4 CI Thermal Comfort (EQc5) ASHRAE Standard 55-2010 (Option 1) meets the Federal Requirements for thermal comfort as required by ASHRAE 55-2004. LEED v4 CI Thermal Comfort (EQc5) references the updated and more stringent version of the standard; ASHRAE 55-2010. The Federal Requirement for ventilation is addressed by ASHRAE Standard 62.1-2004 and is discussed in the previous section. The 3/4 circle rating is for thermal comfort only. **Thermal Comfort (EQ Credit 5) (1 pt.)** Option 1: ASHRAE Standard 55-2010 Design to ASHRAE 55.1-2010 Standard . Option 2: ISO and CEN Standards Design the HVAC systems and envelope to meet the requirements of the applicable standard: ISO 7730:2005 or CEN Standard EN 15251:2007. In addition, individual thermal comfort controls need to be provided to at least 50% of individual occupants and also in multioccupant spaces
What is the baseline or point of comparison?	N/A		Option 1: ASHRAE Standard 55-2010 Option 2: ISO and CEN Standards
What is the range of requirements to achieve the metric?	N/A		Option 1: Compliance (1 pt.) Option 2: Compliance (1 pt.)
What standards or tools are required for the metric?	ASHRAE Standard 55-2004 and ASHRAE Standard 62.1-2007		ASHRAE Standard 55-2010,ISOI 7730-2005, EN 15251:2007
Daylighting			

Indoor Environment

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	The 2008 Guiding Principles' Guidance for Existing Buildings identifies acceptable two strategies: provide daylighting in 50% of occupied spaces or provide occupant control of lighting in 50% of occupied spaces. For leased spaces, EISA provides specifications for lighting that address both energy use and luminescence. Wattage is limited to no more than 2.0 W based on the ANSI/BOMA Standard for Office Space, with fixtures producing an average light level of 50 footcandles at working surface height. Occupancy sensors and/or automatic lighting controls must also be provided.	◑	**Summary:** LEED v4 CI is related to but does not directly align with the Federal Requirements. Daylight (EQ Credit 7) would meet the Federal Requirement requiring 50% daylight, although LEED v4 CI uses a different metric and calculation methodology than the Federal Requirements, LEED's metric of 300 lux is likely greater than a daylight factor of 2%, assuming this is the requirement for EB (the latter depends on outdoor conditions, although even at full daylight, outdoor light levels are ~10,000 lux, which would make a 2% daylight factor = 200 lux, less than the 300 specified by LEED c4 CI). However, LEED v4 CI allows for a lower percentage of the building's regularly occupied areas to be daylit (55% of regularly occupied areas) to earn 2 points, while the federal government calls for 75% of all space occupied for critical visual tasks. Although, it may be that 75% of all space occupied is actually less than 55% of all regularly occupied areas, depending on the use, the difference in methodology is sufficient to require that a project team earn the number of points associated with 75% of regularly occupied daylit areas to meet the Federal Requirement. LEED v4 CI does not have a requirement to limit lighting density to 2.0 W/SF, although the ASHRAE 90.1-2010 standard requires an average of 17% lighting power reduction through the space. Similarly, there is no requirement for footcandles at working surface height. The requirements of Interior Lighting (EQ Credit 6) support quality interior lighting, but do not require specified footcandles. **Interior Lighting (EQ Credit 6) (1 pt.)** Option 2: Requires that the project choose four of 8 lighting strategies to implement in the project including the use of fixtures with a luminance of less than 2,500 cd/m2 between 45 and 90 degrees from nadir, light sources with a CRI of 80 or higher, extended life light sources, and reflectance and illumination of surfaces. (1 pt.) **Daylight (EQ Credit 7) (1-3 pts.)** Option 1: Simulation: Spatial Daylight Autonomy and Annual Sunlight Exposure (2-3 pts.) Provide a daylight simulation with a Spatial Daylight Autonomy (sDA) 300/50% for 55-90% of regularly occupied floor area and meet stated requirements. Option 2: Simulation (1-2 pts.) Computer modeling to demonstrate 300-3,000 lux for 9am and 3pm for 75%-90% with furniture. Option 3: Measurement (2-3 pts.) Demonstrate 300-3,000 lux for 9am and 3pm for 75%-90% of regularly occupied space; with furniture. Note: 1 lux = 0.0929 foot candle
What is the baseline or point of comparison?	All space occupied for critical visual tasks		**EQc6:** N/A **EQc7:** Regularly occupied floor area
What is the range of requirements to achieve the metric?	75%		**EQc6:** Compliance (1 pt.) **EQc7:** 55%-90% (1-3 pts.)
What standards or tools are required for the metric?			Daylight and quality views calculator provided by USGBC

Environmental Tobacco Smoke Control

Indoor Environment

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Implement a policy and post signage indicating that smoking is prohibited within the building and within 25 feet of all building entrances, operable windows, and	●	**Summary:** LEED v4 CI meets the Federal Requirement. **Environmental Tobacco Smoke Control (EQ Prerequisite 2)** Smoking is prohibited in the building and within 25ft of entrances, outdoor air intakes, and operable windows.
What is the baseline or point of comparison?	N/A		N/A
What is the range of requirements to achieve the metric?	N/A		N/A
What standards or tools are required for the metric?	N/A		N/A
Moisture Control			
Does the metric help a building meet a current Federal Requirement?	Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks related to moisture.	◑	**Summary:** LEED v4 CI is related to but not directly aligned with the Federal Requirements. Construction Indoor Air Quality Management Plan (EQ Credit 3) addresses elements of moisture control through the protection of building materials during construction. Thermal Comfort (EQ Credit 5) addresses moisture as an indicator of comfort. Input from occupant comfort surveys may inform building operators about moisture problems and appropriate humidity level, but does not specifically address maintenance/operations. Furthermore, LEED v4 CI does not require design teams to explicitly plan for potential moisture control issues, and therefore does not meet the Federal Requirements. **Construction Indoor Air Quality Management Plan (EQ Credit 3) (1 pt.)** Requires projects to meet or exceed all applicable recommended control measures of the SMACNA IAQ Guidelines, including the protection of absorptive materials stored on-site and installed from moisture damage. **Thermal Comfort (EQ Credit 5) (1 pt.)** To achieve the credit, projects must be designed to ASHRAE 55-2010 Standard. In addition, LEED v4 CI has combined requirements for controllability of systems with this credit to enhance occupant comfort and well-being. In addition, individual thermal comfort controls need to be provided to at least 50% of individual occupants and also in multioccupant spaces. This credit addresses moisture in the context of occupant comfort and does not address installed materials or ongoing maintenance/operations strategies for moisture control.
What is the baseline or point of comparison?	N/A		**EQc3:** Compliance **EQc5:** 55.1-2010: N/A
What is the range of requirements to achieve the metric?	N/A		**EQc3:** Compliance (2 pt.) **EQc5:** The entire building should be designed to ASHRAE 55.1-2010 and provide occupants controls (1 pt.)
What standards or tools are required for	N/A		Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3), ASHRAE 52.2-2007, CEN Standard EN 779-2002, ASHRAE Standard 55-2010,ISOI 7730-2005, EN 15251:2007
Protect Indoor Air Quality During Construction			

Indoor Environment

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 2007. After construction and prior to occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, continue flush-out as necessary to minimize exposure to contaminants from new building materials.		**Summary:** Earning LEED v4 CI Construction indoor Air Quality Management Plan (EQ Credit 3) and Indoor Air Quality Assessment (EQ Credit 4) will meet the Federal Requirements. LEED v4 CI Construction indoor Air Quality Management Plan (EQ Credit 3) requires best practices on site during construction and meets the requirements in SMACNA, and Indoor Air Quality Assessment (EQ Credit 4) requires a volumetric air change protocol to meet credit requirements. Although the Federal Requirements are based on duration of flush out, the amount of time required to exchange the prescribed volume of air in the LEED v4 CI requirements would almost certainly exceed the 72 hours called for by the Federal Requirements. LEED v4 CI also allows projects to conduct air quality testing as an alternative to the building flush out. Air quality testing is not recognized in the Federal Requirements. **Construction indoor Air Quality Management Plan (EQ Credit 3) (1 pt.)** Requires plans to be developed and implemented to protect IAQ during construction and requires SMACNA, 2nd edition, 2007, ANSI/SMACNA 008-2008, Chapter 3 standards be met. **Indoor Air Quality Assessment (EQ Credit 4) (1-2 pts.)** Option 1: Flush-out (1 pt.) Path 1: Prior to occupancy - requires a building flush out of 14,000 cubit feet of outdoor air per square foot of gross floor area while maintaining a temperature between 60-80 degrees F and humidity no greater than 80% Path 2: During occupancy - requires a building flush out of 3,500 cubit feet of outdoor air per square foot of gross floor area while maintaining a temperature between 60-80 degrees F and humidity no greater than 80%. This conditions must be maintained until 14,000 cubic feet of outdoor air per square foot has been delivered to the space. Option 2: Air testing (2 pts.)
What is the baseline or point of comparison?			**EQc3:** N/A **EQc4:** Option 1: 14,000 cubic feet of outdoor air per square foot of or air has been delivered to the space Option 2: air quality testing
What is the range of requirements to achieve the metric?			**EQc3:** Compliance (1 pt.) **EQc4:** Option 1: Compliance (1 pt.) Option 2: Compliance (2 pts.)
What standards or tools are required for	N/A		Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008 (chapter 3)

Low Emitting Material

Indoor Environment

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Low-Emitting Materials. Specify materials and products with low pollutant emissions, including composite wood products, adhesives, sealants, interior paints and finishes, carpet systems, and furnishings.	◕	**Summary:** If the LEED v4 CI credit is achieved, then the project will meet the federal requirements. The products covered by LEED align with the Federal Requirements. **Low-Emitting Materials (EQ Credit 2) (1-3 pts.)** Option 1: Product Category Calculations (1-3 pts.) Compliance with the credit is met by meeting set requirements per material category. Option 2: Budget Calculation Method (1-3 pts.) Compliance of 50%, 70% or 90% of products Categories: Interior paints and coatings, interior adhesives and sealants, flooring, composite wood, ceilings/walls/thermal/acoustic insulation, and furniture.
What is the baseline or point of comparison?	N/A		Option 1: Requirements for each of the six categories Option 2: Percentage of compliant materials
What is the range of requirements to achieve the metric?	N/A		Option 1: Compliance with 3-6 our of 6 product categories (1-3 pts.) Option 2: 50%, 70%, 0r 90% of products (1-3 pts.)
What standards or tools are required for the metric?			N/A
Acoustics (Not in GP)			
Does the metric help a building meet a current Federal Requirement?	EISA section 436 identifies acoustics as an element of indoor environmental quality to be considered during the certification system review.	◕	**Summary:** If the LEED v4 CI EQ Credit 9 is achieved, the project will meet the Federal Requirement of promoting improved indoor environmental quality through acoustics. **EQ Credit 9: Acoustic Performance (2 pts.)** Requires that all occupied spaces meet stated requirements, as applicable, for HVAC background noise, sound transmission, reverberation time, and sound reinforcement and masking systems.
What is the baseline or point of comparison?	N/A		Specific requirements for each parameter.
What is the range of requirements to achieve the metric?	N/A		Compliance (2 pts.)
What standards or tools are required for	N/A		ASHRAE 2011, HVAC Applications Handbook, Chapter 48, Noise and Vibration Control, AHRI Standard 885-2008, or local equivalent

Materials

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Recycled Content			
Does the metric help a building meet a current Federal Requirement?	Per Section 6002 of the Resource Conservation and Recovery Act (RCRA), for EPA-designated products, specify products meeting or exceeding EPA's recycled content recommendations. For other products, specify materials with recycled content when practicable. If EPA-designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building. EPA's recycled content product designations and recycled content recommendations are available on EPA's Comprehensive Procurement Guideline web site at <www.epa.gov/cpg>.	◑	**Summary:** LEED v4 CI is related to but not directly aligned with the Federal Requirements. LEED v4 CI does not require the specification or use of EPA-designated products, although credit is awarded for a variety of recycled content materials. The Federal Requirements rely on the EPA's guideline which is specific to specifying recycled content in a variety of construction materials. Building Product Disclosure and Optimization - Sourcing of Raw Materials (ME Credit 4) may be achieved without the specification of any recycled content materials. Because of this, LEED v4 CI is related to but not directly aligned with the Federal Requirements. If EPA-designated products with recycled content are chosen to attain the credit, the Federal Requirement could be met. **Building Product Disclosure and Optimization - Raw Materials Extraction (MR Credit 4) (option 2) (1 pt.)** LEED v4 CI combines several environmentally preferable attributes into a single credit for sourcing of raw materials that covers extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content. To achieve the credit, projects must specify products that meet one of the above criteria for 25% of project materials by cost. There is no guarantee that recycled content materials will be chosen.
What is the baseline or point of comparison?	n/a		Total cost of materials on the project (1 pt.)
What is the range of requirements to achieve the metric?	n/a		25% project cost threshold for credit achievement
What standards or tools are required for the metric?	EPA's Comprehensive Procurement Guideline		N/A
Bio-based Content			

Materials

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Per Section 9002 of the Farm Security and Rural Investment Act (FSRIA), for USDA-designated products, specify products with the highest content level per USDA's bio-based content recommendations. For other products, specify bio-based products made from rapidly renewable resources and certified sustainable wood products. If these designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building. USDA's bio-based product designations and bio-based content recommendations are available on USDA's BioPreferred web site at <www.usda.gov/biopreferred>.	◑	**Summary:** LEED v4 CI is related to but not directly aligned with the Federal Requirements. The Federal Requirements rely on the USDA's guideline which is specific to specifying bio-based content in a variety of construction materials. If USDA-designated products with bio-based materials are chosen to attain the credit, the Federal Requirement could be met. LEED v4 CI Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 4) does not require the specification or use of USDA-designated products, although credit is awarded for a variety of bio-based products. The credit requires that bio-based materials meet the Sustainable Agriculture Standard to receive credit and that certified wood comply with the Forest Stewardship Council standard. **Building Product Disclosure and Optimization - Raw Materials Extraction (MR Credit 4) (option 2) (1 pt.)** LEED v4 CI combines several environmentally preferable attributes into a single credit for sourcing of raw materials that covers extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content. To achieve the credit, projects must specify products that meet one of the above criteria for 25% of project materials by cost. There is no guarantee that bio-based content materials will be chosen.
What is the baseline or point of comparison?	n/a		Total cost of materials on the project; bio-based products meeting the Sustainable Agriculture Standard are valued at 1.0 x applicable content % x product cost. FSC wood products are valued at product cost x FSC % as defined.
What is the range of requirements to achieve the metric?	n/a		Bio-based content and FSC wood contribute to the 25% project cost threshold for credit achievement.
What standards or tools are required for the metric?	USDA's Bio Preferred website		N/A

Environmentally Preferable Products

Materials

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Use products that have a lesser or reduced effect on human health and the environment over their lifecycle when compared with competing products or services that serve the same purpose. A number of standards and ecolabels are available in the marketplace to assist specifies in making environmentally preferable decisions. For recommendations, consult the Federal Green Construction Guide for Specifies at <www.wbdg.org/design/greenspec.php>.		**Summary:** If LEED v4 CI Interiors Life-Cycle Impact Reduction (MR Credit 2) and Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 3) are achieved, then the project will meet the Federal Requirements. While MRc2 addresses lifecycle impact reductions as specified in the Federal Requirements, Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 3) provides an opportunity for a project to meet the Federal Requirement for eco-labels. LEED v4 CI addresses lifecycle impacts by requiring the reuse or salvage of interior elements, furniture, and through design for flexibility. Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 3) addressed environmental attributes such as bio-based materials, recycled content and regional materials, all of which are thought to reduce the environmental impact of materials and are considered elements of environmentally preferable products. In addition, the achievement of Building Product Disclosure and Optimization - Sourcing of Raw Materials (MR Credit 4) contains specific actions around ingredient inventories that may lead to improved human health outcomes. While such transparency is not specifically addressed in the Federal Requirements, it will support the goal of reducing the effect of building products on human health. **Interiors Life-Cycle Impact Reduction (MR Credit 2) (1-4 pts.)** Option 1: Interior Reuse (2 pts.) Reuse or salvage interior nonstructural elements for at least 50% of the surface area. Option 2: Furniture Reuse (1 pt.) Reuse, salvage, or refurbish furniture and furnishings for at least 30% of the total furniture and furnishings cost. Option 3: Design for Flexibility (1 pt.) Conduct an integrative planning process to increase the useful life of the space through incorporate of strategies as described by LEED v4 CI. **Building Product Disclosure and Optimization - Environmental Product Declarations (MR Credit 3) (1-2 pts.)** Option 1: Credit can be achieved in Option 1 for Environmental Product Declarations with the permanent installation of at least 20 different products sourced from at least five different manufacturers that meet one of the disclosure criteria summarized below: (i) Product-specific declarations (ISO 14044) (ii) Environmental product declarations (ISO 14025, 14040, 14044, and EN 15804 or ISO 21930) Option 2: Credit can also be achieved with Option 2 for multi-attribute optimization of 50% of materials by cost for products that reduce their impact below industry averages in at least three of the following categories: -global warming potential -depletion of the stratospheric ozone layer -acidification of land and water resources -eutrophication -formation of tropospheric ozone -depletion of nonrenewable energy sources **Building Product Disclosure and Optimization - Raw Materials Extraction (MR Credit 4) (Option 2) (1 pt.)**

Materials

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
			LEED v4 CI combines several environmentally preferable attributes into a single credit for sourcing of raw materials that covers extended producer responsibility, bio-based materials, wood products, materials reuse, and recycled content. To achieve the credit, projects must specify products that meet one of the above criteria for 25% of project materials by cost. As such there is no guarantee that recycled content materials will be chosen. Materials and products that are extracted, manufactured and purchased within 100 miles of the project site are valued at 200% of their contributing costs based on the criteria above. **Building Product Disclosure and Optimization - Material Ingredients (MR Credit 5) (1-2 pts.)** Option 1: Use 20 products that inventory chemicals to at least 0.1% based on approved inventory programs (1 pt.) Option 2: Use products that optimize ingredients based on approved programs for 25% of project building product costs (1 pt.) Option 3: Use products with supply chain optimization as described by LEED v4 CI for 25% of project building product costs (1 pt.)
What is the baseline or point of comparison?	n/a		**MRc2:** Option 1: Total surface area (2 pts.) Option 2: Total cost of furniture / furnishings (1 pt.) Option 3: Number of flexible design strategies (1 pt.) **MRc3:** Option 1: 20 different products (1 pt.) Option 2: Total cost of materials (1 pt.) **MRc4:** Option 2: Total cost of materials (1 pt.) **MRc5:** Option 1: 20 different products (1 pt.) Option 2: Total cost of materials (1pt.)
What is the range of requirements to achieve the metric?	n/a		**MRc2:** Option 1: 50% Option 2: 30% Option 3: 3 of 5 prescribed strategies **MRc3:** Option 1: Compliance Option 2: 50% **MRc4:** Option 2: 25% **MRc5:** Option 1: Compliance Option 2: 25%
What standards or tools are required for the metric?	N/A		N/A

Materials

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Waste and Materials Management			
Does the metric help a building meet a current Federal Requirement?	Incorporate adequate space, equipment, and transport accommodations for recycling in the building design. During a project's planning stage, identify local recycling and salvage operations that could process site-related construction and demolition materials. During construction, recycle or salvage at least 50 percent of the non-hazardous construction, demolition and land clearing materials, excluding soil, where markets or onsite recycling opportunities exist. Provide salvage, reuse and recycling services for waste generated from major renovations, where markets or onsite recycling opportunities exist.	◕	**Summary:** If the LEED v4 CI Construction and Demolition Waste Management (MR Credit 6) Option 1 is achieved, then the project will meet the Federal Requirements for diverting construction waste from the landfill through recycling, salvage and reuse. Storage and Collection of Recyclables (MR Prerequisite 1) meets the requirement for the collection of recyclables during operations. Construction and Demolition Waste Management (MR Credit 6) relies on a lbs./SF metric that is not comparable to the Federal Requirement. **Storage and Collection of Recyclables (MR Prerequisite 1)** Requires dedicated areas that are accessible to waste haulers and building occupants for the collection and storage of recyclables. In addition to paper, cardboard, glass, plastic and metals, LEED v4 CI also requires the collection and recycling of two of the following three waste types: batteries, mercury-containing lamps, and e-waste. **Construction and Demolition Waste Management Planning (MR Prerequisite 2)** Develop and implement a construction and demolition waste management plan that establishes waste diversion goals for the project in at least five material categories, as well as logistical considerations and recycling facility information. **Construction and Demolition Waste Management (MR Credit 6) (1-2 pts.)** Option 1: Diversion (1-2 pts.) Credit requires diversion of 50% of construction and demolition material from at least three material streams or 75% including waste from 4 material streams. Option 2: Reduction of Total Waste (2 pts.) Reduce total waste generated to no more than 2.5 lbs./SF
What is the baseline or point of comparison?	Total non-hazardous construction, demolition and land clearing materials		**MRp1:** None **MRp2**: None **MRc6:** Option 1: Total C&D debris excluding hazardous waste, land-clearing debris, soil, and landscaping materials. Option 2: None
What is the range of requirements to achieve the metric?	n/a		**MRp1:** Compliance **MRp2:** Compliance **MRc6:** Option 1: 50% for 3 materials streams, or 75% for 4 material streams Option 2: 2.5 lbs./sf
What standards or tools are required for the metric?	N/A		N/A
Ozone Depleting Compounds			

Materials

Review Questions	Federal Requirements		LEED v4 ID+C: Commercial Interiors (2014 Update)
Does the metric help a building meet a current Federal Requirement?	Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account lifecycle impacts.	◑	**Summary**: LEED v4 CI is related to but not directly aligned with the Federal Requirements. Fundamental Refrigerant Management (EA Prerequisite 3) supports the Federal Requirements by restricting the use of CFCs. Enhanced Refrigerant Management (EA Credit 5) requires a minimization or elimination of refrigeration compounds that contribute to ozone depletion and climate change. It is possible to achieve the prerequisite and credit without eliminating ozone depleting compounds as described in the Federal Requirements. In addition, LEED v4 CI only addresses refrigerants, rather than all product types addressed in the Montreal Protocol and referred to as EPP in the Federal Requirements. **Fundamental Refrigerant Management (EA Prerequisite 3)** Restricts the use of CFCs in buildings. For projects that have existing CFC equipment, phase-out is required. **Enhanced Refrigerant Management (EA Credit 5) (1 pt.)** EA Credit 5 requires that either no refrigerants or low-impact refrigerants (zero ODP), or a calculation of the impact of specified equipment to ensure it is beneath the set threshold. Addresses building refrigeration equipment on a lifecycle basis including equipment operations to access the lifecycle ozone depletion potential and global warming potential of refrigerants over the life of the equipment.
What is the baseline or point of comparison?	n/a		**EAp3:** Zero CFC-based refrigerants **EAc5:** Total refrigerant impact per ton
What is the range of requirements to achieve the	n/a		**EAp3:** Compliance **EAc5:** Compliance (1 pt.)
What standards or tools are required for the metric?	Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990		U.S. EPA Clean Air Act, Title VI, Section 608, Refrigerant Recycling Rule

Appendix F: LEED v. 4 CI Conformance Methods: Measured, Calculated and Evidence of Intent

MCI Assessment:
LEED v4 ID+C: Commercial Interiors

M= Measured Performance
C= Calculated Performance
I= Evidence of Intent

GP	Guiding Principles New Construction and Major Renovations	LEED v4 CI
	Robustness – Integrated Principles	
I/M	Integrated Design	I/M
M	Commissioning	M
I	Building System Controls (Not in GP)	I/C/M
I	Siting	C/M
I/C	Greenhouse Gas	I/C/M
Comments: Greenhouse Gas is considered C/M because a wide variety of strategies that are both C and M were identified in the Robustness table as supporting the Federal Requirement.		
	Energy	
C/M	Energy Efficiency	I/C
I/C	On-Site Renewable Energy & Green Power	C
I/M	Measurement and Verification	I/M
C/M	Benchmarking	I/M
I	Use ENERGY STAR, FEMP or EPEAT Products	N/A
Comments: Install meters is considered M because meters are installed in the project.		
	Water	
C	Indoor Water	C
I	Process Water	I/C
N/A	Stormwater	N/A
I	Water-Efficiency Products	I

Appendix F: LEED v. 4 CI Conformance Methods: Measured, Calculated and Evidence of Intent

Comments:
Indoor water use reductions, as well as the project volumes of harvested rainwater are C because the volumes are calculated in both cases.

The installation of WaterSense products is an M because they are required to be installed.

Process water is considered M because measures identified in LEED are prescriptive and will be installed.

Stormwater is not applicable to leases.

Resources/Materials		
I	Recycled Content	C
I	Biobased Content	C
I	Environmentally Preferable Products	I/C
I/C	Waste and Materials Management	I/C/M
I/M	Ozone Depleting Compounds	I/C

Comments:
LEED v4 NC relies on the measured contributions based on environmental attributes such as recycled content, biobased materials, and environmentally preferable materials. The calculations consider weight, percent of product, and product costs.

Construction waste management is measured according to weight or volume.

LEED v4 provides for a calculated approach in the case that ozone depleting compounds are not fully eliminated.

Indoor Environment		
C	Ventilation	I/C
C	Thermal Comfort	C
I/C	Daylighting & Lighting Controls	I/C/M
I	Environmental Tobacco Smoke Control	I
I	Moisture Control	I/C
M	Protect Indoor Air Quality during Construction	M
I	Acoustics (Not in GP)	I/C/M
I	Low-Emitting Materials	I/C

Appendix F: LEED v. 4 CI Conformance Methods: Measured, Calculated and Evidence of Intent

Comments:
Low-emitting materials may be achieved through either a compliance-based or calculated approach.

Daylighting would ideally be measured, but because it is primarily a design consideration, calculating it through simulations is the preferred approach. The simulations are effectively a design tool to improve daylighting outcomes and performance of the building.

APPENDIX G: USGBC COMMENTS

COMMENTS PROVIDED BY USGBC IN RESPONSE TO A REQUEST TO IDENTIFY CHANGES TO NON-ROBUSTNESS CRITERIA SINCE COMPLETION OF THE THE 2012 PNNL REPORT.

LEED continues to be the most widely used green building certification in the United States. USGBC reports that the Federal government has certified 1510 facilities to LEED as of May 2014.

LEED v4 replaced LEED 2009 in 2013. LEED v4 includes 21 separate systems in five categories:

- Building Design and Construction (BD+C)
- Building Operations and Maintenance (O+M)
- Interior Design and Construction (ID+C)
- Neighborhood Development (ND)
- Homes

The non-robustness criteria and approach developed in the 2012 PNNL Report include independence, availability, verification, transparency, consensus-based, system maturity, usability, national recognition. USGBC's approach to development and implementation of the LEED systems has not changed significantly since the 2012 PNNL Report.

The 2012 PNNL Report found that the LEED system generally aligned well with the EISA-defined criteria included in the non-robustness category. There have been no significant changes to LEED since completion of the 2012 PNNL Report that would change the conclusion.

Independence

Criterion definition: Assessors/auditors have no stake in whether a building receives certification

USGBC Summary: Projects are randomly assigned by the Green Building Certification Institute (GBCI), a separately incorporated entity, through an unbiased pool of qualified assessors that must confirm the absence of any conflict of interest. Reviewers are selected from a pool of highly qualified,

unbiased teams. The LEED v4 program is a documentation-based verification program.

Availability

Criterion definition: Assessors/auditors are available to evaluate a building.

USGBC Summary: Generally, three LEED reviewers (assessors) are assigned to each project. Certifications involve a preliminary and final review process and typically require 2-3 months from submission to certification by GBCI, which receives ~100 new applications for reviewers per week.

Verification

Criterion definition: A documented standard verification method and process must be followed by assessors and auditors.

USGBC Summary: LEED Online is the tool used for both application and review. GBCI reviewers (assessors) must use the published, balloted LEED rating system requirements. The USGBC's technical committee structure may be used to address unique or complex evaluation needs.

Transparency

Criterion definition: (1) There is a documented approach for the review and consideration of public comments; (2) Public comments are collected on a regular basis; (3) Public comments are reflected in the certification systems; (4) Development and updating process of the certification system is documented and publicly available.

USGBC Summary: USGBC solicits and responds to all stakeholder comments received during a formal LEED public comment period via a publicly available online portal. Comments submitted through the online public comment forum are reviewed by LEED volunteer committees; changes to the draft rating system are made based on the technical merit of the comment. In parallel to the updating of the draft based on stakeholder feedback, a response to each public comment is developed. Both the revised draft and the responses to the public comments are posted online. A summary of draft rating system changes and committee meeting minutes are posted on the USGBC website.

Consensus-based

Criterion definition: The certification system contains the attributes of a voluntary consensus standards body defined in OMB Circular A-119: openness, balance of interest, due process, an appeal process, and consensus.

USGBC Summary: USGBC membership is comprised of a diverse group of nearly 13,000 companies representing virtually all aspects of the building

industry. LEED committees are populated by a diverse group of technical and market experts who donate their time and expertise to advance LEED. The USGBC engaged hundreds of volunteers, conducted six public comment periods, and responded to more than 22,000 public comments during LEED v4 development. LEED Pilot Credits are used to test proposed or revised LEED credits. The final draft of LEED v4 was approved by 86% of the consensus body members.

System maturity

Criterion definition: (1) Certification system is effectively linked to latest tools and standards; (2) Certification system has components to track building performance post-occupancy; (3) Certification is used as basis for development of other systems; (4) Certification system has been consistently updated over time.

USGBC Summary: LEED continues to stay current with changes to referenced standards by enabling use of updated referenced standards via periodic addenda, Credit Interpretations, LEED interpretations and certification precedent. Updates are periodic without a formal schedule, and have occurred four times prior to the 2013 update to v4. LEED is updated through continuous improvement, which involves a regular development cycle for revisions to the rating system. The LEED v4 EB standards evaluate existing buildings and include mandatory metering as well as energy and water use reporting Prerequisites. At least 22 other systems have been developed based on LEED. USGBC research indicates that programs (sometimes multiple systems) in these countries have been influenced by LEED (not a complete list):

- UK
- Australia
- UAE
- Japan
- France
- Germany
- India
- Spain
- Brazil
- China

- Portugal

Usability

Criterion definition: (1) Cost of use is affordable; (2) Technical knowledge needed to use the certification system is generally available in the design and construction industry; (3) Certification system requires professional rigor and judgment rather than leading user prescriptive solutions; (4) Certification system organization provides product support; (5) Certification system is well-defined, easily communicated, and clearly understood among multiple parties.

USGBC Summary: System fees for registration and certification of building projects range from $3,150 to $33,400 for a large building with expedited certification. Credit appeals are $500-$800. Reference guides are available for $249. USGBC develops and maintains tools to support the system that are regularly updated. The various market sectors using LEED have individual resource pages to assist. The LEED Reference Guides include detailed information on the process for achieving certification, including intent, requirements, point values, environmental and economic issues, related credits, summaries of reference standards and other relevant information for each credit.

National recognition

Criterion definition: (1) Certification system is recognized academically; (2) Certification system is recognized within the buildings industry (including real estate and construction industry); (3) Certification system is recognized within the Federal sector.

USGBC Summary: Curriculums in at least 4 of the AIA's top architecture schools have coursework that identifies the LEED system. Approximately 1300 students attend the annual USGBC Greenbuild conference; USGBC supports a network of 146 student groups representing ~3100 students. LEED certifications presently number 21,420 certified buildings and 37,414 registered buildings, together representing 11+ billion square feet in 93 countries and territories. Policies adopting or referencing LEED have been adopted in 33 US states and 2 territories and 469 cities. The LEED system has been recognized by 110 member professional societies and trade associations and by 20 Federal agencies and at least 1510 Federal buildings representing ~157 million square feet have been certified as of April 2014.

PART 2: COMMENTS PROVIDED BY USGBC DURING THE PEER REVIEW PROCESS.

	page iv	"LEED v4 NC and CI rely on calculations to achieve the energy efficiency credits." For both the BD+C and ID+C v4 rating systems, prerequisites have been added which require energy and water reporting. Combined, these new mandatory requirements coupled with mandatory recertification requirements in the O+M rating system effectively channel all design assumptions into an on-going performance verification program. While it is true that ID+C and BD+C rating systems rely on simulation for initial award of credits, the structure created in LEED v4 moves projects directly towards O+M over time. The referenced statement appears several places (page iv, 3-2, 3-4) within the review and could be augmented (as follows) to provide a more complete understanding of how the entire LEED system has been designed: LEED v4 NC and CI rely on building simulations for the initial award of energy efficiency credits but both rating systems require reporting of operational energy use to USGBC. This data-sharing requirement coupled with recertification requirements in LEED v4 EB are designed to create a culture where projects initially certified in either the NC or CI rating system are moved into on-going performance verification seamlessly.
	page vii	This would be the ideal place to include information on the average credit achievement of LEED-certified federal government projects. Because LEED requires the achievement of at least 40 points, it is entirely logical to assume that certain achievement of federal projects are effectively mandatory. This difference is a critical aspect associated with any comparison to the FGP. While LEED does not mandate specific actions, which, if made prerequisites, would align project outcomes with the FGP, projects are required to achieve credits in order to certify (satisfaction of prerequisites alone does not achieve certification). This critical distinction between a regulatory mechanism like the FGP and a leadership/market transformation tool like LEED is not described as completely as might be helpful for individuals reviewing this report and seeking to be able to act on the content. The credit achievement of the average federal government project is a much more representative and true measure of the outcome of a LEED project compared to the FGP requirements. Additionally, the broad alignment between the goals the FGPs were created to advance and the system goals of LEED v4 very clearly drive projects to achieve LEED credits that seek the same outcomes as those the FGPs are based on.
	page 1-2	Regarding "Step 1-GBCS System Owner Engagement," it is not clear what GBCS is an acronym for.
	page 2-3	The LEED for Homes rating system has several field verification requirements.
	page 2-5	At least 22 other international systems have been developed based on LEED. It may be helpful to include a date tied to federal government certified and registered project counts (e.g. "as of May 2014").

	page 3-10	LEED O+M does have a credit that deals with thermal comfort–LEED O+M v4 Thermal comfort. While the credit does not directly address controls, it's not clear how this credit, in mechanically conditioned buildings, can be achieved without some type of control system. As much as is possible, LEED credits attempt to encourage projects towards a defined outcome (thermal comfort, energy efficiency, etc) without prescribing how these outcomes will be achieved. This focus on performance vs. prescriptive behavior is one of the significant advancements in v4 and has been widely acknowledged as a benefit to both project and owner because it allows for maximum innovation and creativity.
	page 3-12	Significant steps to weave GHG reduction strategies into the credits in LEED v4 that deal with procurement of on-going consumables and building materials have been made. In particular, the Building Life Cycle Impact Reduction and EPD credits in the BD+C rating system and the Interiors Life Cycle Impact Reduction and EPD credits in the ID+C rating system provide significant incentive to optimize material use and drive down embodied GHG in building materials.
	Page 3-14.	It's not directly apparent that a 5% reduction from 90.1-2010 baseline is different than a 30%/20% reduction from 90.1-2007 for all types of buildings that the federal government builds and operates. We are aware of some studies but are currently trying to identify the definitive answer on this issue.
	page 3-21 and 3-23	USGBC has been engaged with several government departments since the launch of LEED v4 related to the inclusion of mandatory reporting requirements on energy and water. We have successfully worked with the Department of Defense to leverage the internal mechanisms that exist for energy and water use reporting as acceptable proxies for direct reporting to USGBC. While there are details that remain to be worked out for the rest of the federal government, we anticipate that reporting mechanisms similar to those used by DoD can be leveraged to reduce/eliminate the potential for duplicative reporting requirements.
table 1		Because the scope of interiors projects can vary significantly, it's not clear that the same whole building framework which Table 1 is built on is appropriate. Rather than leave some of the sections blank, we recommend the use of N/A or "out of scope" to indicate out of scope issues for the following items: Outdoor Water Storm Water Measurement of Water Use Integrated Pest Management

table 1		Measurement of Water Use–LEED NC v4 column LEED v4 BD+C has both a prerequisite and credit for water metering. If not fully in compliance with FGPs, it seems at least a three-quarter circle is warranted here. From the body of the report: LEED v4 NC and CI include a prerequisite compliance path that fully aligns with Federal requirements for water reduction, but the credit must be achieved in LEED v4 EB. Only LEED v4 CI fully meets Federal requirements for process water Table 1 does not indicate this alignment–perhaps an oversight? If not fully in compliance with FGPs, it seems at least a three-quarter circle is warranted here. From the body of the report: There are no prerequisites for stormwater and outdoor water use, This is incorrect. LEEDv4 BD+C has a prerequisite for reduction in outdoor water use that requires either no irrigation or a 30% reduction from baseline. Was this comment possible referring only to LEED ID+C? If so, it would be helpful to communicate as such.
table 1		Protect Indoor Air Quality During Construction–LEED v4 EB LEED v4 O+M has a credit for the establishment and operation of an Indoor Air Quality Management Program which references EPA's I-BEAM protocols. These protocols require establishment of a plan for IAQ protection during renovation/construction - http://www.epa.gov/iaq/largebldgs/i-beam/text/index.html. If not fully in compliance with FGPs, it seems at least a three-quarter circle is warranted here.