Decarbonization of Buildings
Opportunities, Challenges and Resources

APPA Spring Conference

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Credit(s) earned on completion of this course will be reported to American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.

Certificates of Completion for both AIA members and non-AIA members are available upon request.

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Questions to specific materials, methods or services will be addressed at the conclusion of this presentation.

2

Course Description

- As we continue our collaborative efforts with ASHRAE, join us for a conversation to examine how the ASHRAE standards and guidelines can shape the built environment's future to reduce carbon emissions. We will also look at the impact of ASHRAE government outreach on the legislation and regulations that directly impact the built environment's design, construction, and operation.

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Learning Objectives

- Provide an understanding of the resources that are available or being developed by ASHRAE to facilitate your goals to reduce energy consumption and carbon emissions
- Learn how you can evaluate embodied carbon emissions
- Learn about other programs to improve the facility operations and operational evaluations

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ASHRAE Overview

Founded in 1894

200+ Standards and Guidelines

59 Active Research Projects Total of 907; $76 million

53,000+ Volunteer Members

130+ countries

7,400+ Student Members

15 Regions

190+ Chapters

400+ Student Branches

Industry Classifications

Consulting Engineers
Contractors
Manufacturers
Manufacturing Representatives
Government, Health & Education
Design Build
Architects

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MISSION

To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.

VISION

A healthy and sustainable built environment for all.

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Setting the Stage: Why Building Decarbonization Matters

- Population growth over the next 30 years: 1.9 billion more people, a 24% increase
- Building growth by 2060: 2.5 trillion sq. ft. of additional space will be built; this is equivalent to constructing an entire NYC every month.
- Addressing greenhouse gases from the buildings sector is critical to meeting global temperature rise limits

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ASHRAE's Position on Building Decarbonization

Eliminating GHG emissions from the built environment is essential to address climate change

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ASHRAE's goals…

2030

the global built environment must halve its 2015 GHG emissions

- All new buildings must be NZE
- Widespread EE retrofits of existing assets
- New construction embodied carbon must be reduced by at least 40%

2050

all new and existing assets must be net zero GHG emissions across the whole life cycle

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" Challenge Accepted: Tackling the Climate Crisis."

- We are living in a climate emergency. Our desire to be more comfortable has brought us to a place where we need to make uncomfortable decisions. We can accept the challenge of our day regarding the impact of our buildings on the climate crises by equipping our members with the knowledge they need to design and renovate buildings to address the greenhouse gas emissions of our industry."
- Scoggins' theme highlights the urgency of addressing the climate crisis, examines measures to reduce human impact on the natural environment and offers strategies for making the built environment more resilient and sustainable.
- "An understanding of how climate change affects building planning, design, construction and operation is necessary to properly execute projects going forward. ASHRAE is committed to equipping our members with sufficient knowledge and tools, expanding our efforts of designing energy efficient buildings and providing meaningful leadership, action, resources, and advocacy to the global built environment."

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What ASHRAE is Doing to Help Meet those Goals

Established a Task Force on Building Decarbonization that is:

- ✓Expediting the delivery of technical resources that help design engineers deliver and operate low-carbon buildings
- ✓Ensuring goals are accomplished within the established timeframes
- ✓Collaborating joint building decarbonization initiatives with other organizations
- ✓Coordinating work with other ASHRAE committees to align goals and eliminate bottlenecks

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Four Key Focus Areas

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ASHRAE Building Decarbonization Resources

- Standards and Guidelines
  - Operational carbon: 90.1, 90.2, 90.4, 100, IgCC, 105, 228P
  - GHGs and Refrigerants: Standards 15 & 34
  - Proposed standard to also address embodied carbon/LCA: *Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation*

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90.1 - 2022

- Standard 90.1-2022 marks the first-time onsite generation of renewable energy systems is incorporated as a prescriptive requirement of the standard, recognizing the role of renewables in new construction, echoing similar requirements in several state and local building codes and better positioning new commercial buildings to achieve net zero energy in the future.
- Other key changes include customizable energy credits, a new mechanical system efficiency performance option, requirements to address thermal bridging, expanded criteria for whole-building air-leakage testing, updated lighting power allowances, and additional guidance for using emissions in addition to traditional site, source, and cost-based metrics.

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90.1 - 2022

- ASHRAE received a determination issued by the U.S. Department of Energy (DOE) stating that ANSI/ASHRAE/IES Standard 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings, will increase energy efficiency in commercial buildings subject to the code.
- The standard achieved this determination through the DOE's technical analysis estimating that buildings meeting 90.1-2022 (as compared to the previous 2019 edition) would result in a national average site energy estimate savings increase from 9.8% to 14% (reference as "net" savings).
- The following are DOE's estimates of national savings in commercial buildings:
  - 9.8% site energy savings
  - 9.4% source energy savings
  - 9.3% carbon emissions savings

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90.1 - 2022

- "With the intensified demand for decreased energy consumption and carbon reductions in existing buildings, Standard 90.1 continues to offer essential guidance in shaping building regulations and amplified energy legislation," said 2023-24 ASHRAE President Ginger Scoggins, P.E., Fellow ASHRAE.
- "The DOE's latest determination further solidifies Standard 90.1 as the cornerstone for achieving energy efficiency goals and ultimately moves us closer towards widescale, global building decarbonization of the built environment."

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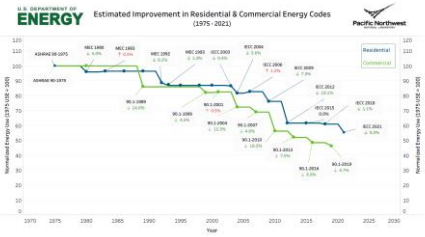
Decarbonization Progress from Energy Conservation Standard 90.1

….. but Jurisdictions need to adopt the most recent version!



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ASHRAE Building Decarbonization Resources (continued)

- Building Performance Standards for Existing Buildings
  - Standard 100 – Energy Efficiency in Existing Buildings
  - Standard 211 – Commercial Building Audits
- Technical Support
  - Training and briefings specific to your needs
  - Non-commercial; apolitical
- Training and Education Courses

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ASHRAE Decarbonization Standards (Continued)

- **105-2021:** Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions
- **147-2019:** Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems
- **227P:** Passive Building Design Standard
- **228P:** Standard Method for Evaluating Zero Net Energy and Zero Net Carbon Building Performance
- **240P:** Evaluating Greenhouse Gas and Carbon Emissions in Building Design, Construction and Operation

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Standards to Address the Decarbonization Needs
Additional Details

Standard 90.1
- Developing a jurisdictional option for net zero energy code adoption
- Setting the direction for 90.1 to target net zero energy by 2031
- Allowing carbon as a metric (Appendix I in 90.1-2022 edition)

Standard 90.2
- Moving at least halfway toward net zero energy by 2023
- Creating an informative appendix for net zero energy/carbon by 2023
- Developing a fully net zero energy and carbon standard by 2025

Standard 100
- Becoming a Building Performance Standards
- Addressing both energy and carbon reductions in existing buildings

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Standards to Address the Decarbonization Needs
Additional Details

Standard 211
- Commercial building energy audit standard
- Developing an informative annex to add carbon audit
- Planning to reconvene Standard 211 to incorporate both energy and GHG reduction audit

Standard 240P
- New ASHRAE/ICC Standard
- Evaluating GHG emissions in building design, construction and operation
- Reviewed and edited the seed document to expedite the standard development

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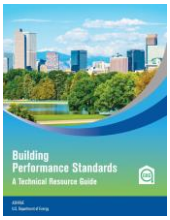
Building Performance Standards Guide



The first in a series of seven guides, Building Performance Standards: A Technical Resource Guide is intended to provide technical basis and resources to policymakers, building owners, facility managers, design professionals, and ASHRAE members when developing and implementing a Building Performance Standard (BPS).

The guide covers BPS aimed toward reducing building operating energy use and resulting emissions and does not cover embodied energy or carbon, which are addressed by The Whole Life Carbon Guide for Building Systems

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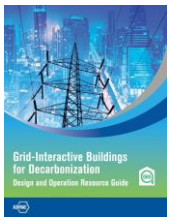
Grid Interactive Buildings Guide



Grid-Interactive Buildings for Decarbonization: Design and Operation Resource Guide. This is the second in a series of guides aimed at addressing the challenge of decarbonization in the built environment.

Buildings have a role in decarbonizing the power grid and managing their carbon budget; therefore, this guide provides information to enable readers to maximize carbon reduction through a building's interaction with the electric power grid.

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Decarbonizing Hospital Buildings

Expected release April 2024:

- This guide for hospital facility managers, capital planners, hospital architectural and engineering teams, sustainability leaders, contractors, and other building stakeholders specifically shows how to reduce GHG emissions in hospital buildings.
- The challenges for decarbonizing healthcare buildings are much more complex than those for other buildings because of their unique needs in terms of the number and complexity of systems, infection prevention needs, regulatory environment, an abundance of technology to deliver healthcare services, and needs for resilience.
- This guide will fill the need for hospitals and provide insight into other building types.

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Heat Pump Application, Design, and Operation Guide

***To be published by the US Department of Energy, expected release April 2024**:*

- This guide for design engineers and building operators will focus on how heat pumps should be applied and how they should be operated in commercial and multifamily buildings to support decarbonization.
- The Heat Pump Application and Operation Guide will represent a critical resource to building designers and operators to support the widespread adoption of this building decarbonization strategy.

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Building Decarbonization Retrofits for Commercial and Multifamily Buildings

***Expected release July 2024**:*

- This guide for design engineers provides a framework for decarbonizing existing commercial and multi-family buildings. Decarbonization of the existing building stock is essential to meet any decarbonization goal.
- This guide will provide specific solutions, guidance, and case studies to decarbonize buildings in the commercial and multi-family building sectors.

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CIBSE TM65 for North America

***Expected release July 2024**:*

- The Chartered Institution of Building Services Engineers (CIBSE) developed and published 'TM65 Embodied carbon in building services: a calculation methodology' in 2021.
- TM65 provides valuable guidance for the MEP community and beyond; however, many of the method's inherent assumptions are specific to the United Kingdom (UK).

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Whole Life Carbon Guide for Building Systems

***Expected release August 2024*:**

- This guide provides design engineers strategies to minimize the whole-life carbon emissions from building mechanical, electrical, and plumbing (MEP) systems.
- Recent studies have shown that the embodied emissions from MEP systems can be between 15% and 49% of the total building embodied emissions and even higher if photovoltaic (PV) systems are included with the building.
- This guide will provide ASHRAE members and others with the definitions, concepts, and comprehensive guidance needed to calculate, interpret, and integrate life cycle data from multiple sources to design MEP systems for low whole-life carbon emissions

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ASHRAE Decarbonization Trainings

- Building Decarbonization 101 (1 hour)
- Additional 1-hour seminars coming this spring
- Multiple ALI decarbonization courses (3 hours)
- Heat Pump Application and Operations (full-day)
- Building Decarbonization Retrofits (full-day)
- Building Decarbonization Audit 2024 (full-day)

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Decarb 101 – Part One

- **Decarb 101 - Part One in a Four-Part Series**
- Part One in a Four-Part Series | This seven-minute video, created by ASHRAE Presidential Member Kent Peterson.
- This video provides an overview of building decarbonization and an introduction to the terminology used in the industry.
- Future presentations focus on the global impact, ASHRAE's involvement and steps on the pathway to decarbonization.

- https://www.ashrae.org/decarb

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Decarb 101 – Part two

- Part two of the Decarb 101 series explains, in 16 minutes, global building decarbonization issues, the role of the electric grid & building embodied carbon. Learn more about ASHRAE's efforts towards building decarbonization at https://www.ashrae.org/decarb.

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Decarb 101 – Part Three

- The third module focuses on ASHRAE's involvement in building decarbonization and ASHRAE presidential member Kent Peterson looks at ASHRAE's connection to decarbonization going back to 1975 with ASHRAE Standard 90 and looks ahead to ASHRAE's 2030 and 2050 global greenhouse gas (GHG) emissions goals for the built environment.
- Learn more about ASHRAE's efforts towards building decarbonization at https://www.ashrae.org/decarb.

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Decarb 101 – Part Four

- In the fourth and final module ASHRAE presidential member Kent Peterson discusses the pathway to decarbonization, emerging issues and opportunities and how you can help. Watch now to learn eight key measures that can help guide decision-making as we work together to decarbonize the built environment.
- Learn more about ASHRAE's efforts towards building decarbonization at https://www.ashrae.org/decarb.

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Center of Excellence for Building Decarbonization (CEBD)

- Provide strategic direction for ASHRAE building decarbonization activities and work with the ASHRAE Planning Committee to incorporate appropriate goals into the Society strategic plan.
- ASHRAE's building decarbonization strategy will be updated annually to keep up with the rapid pace of change in this area.
- Develop, lead, and/or participate in strategic initiatives, generally with partner organizations, that accelerate and advance building decarbonization globally.

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Center of Excellence for Building Decarbonization (CEBD

- Monitor future issues and trends and publicize ASHRAE's decarbonization work globally to establish ASHRAE's leadership position, in partnership with Marketing.
- Coordinate joint initiatives, events, and projects with other U.S. and international organizations whose work is complementary to ASHRAE's building decarbonization activities.
- Work with Government Affairs to provide reliable technical information on decarbonization to policymakers, media, and the public.

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Supporting Activities

- These operational activities will be led by one or more relevant councils, committees, or Decarbonization Task Groups (DTGs) across the global ASHRAE organization. The CEBD will take a supporting role in these activities. These activities will be coordinated by ASHRAE staff, with further assistance provided by CEBD members as needed.
- Technical Resources
- Technical Review
- Standards Coordination
- Training Development
- Resource Internationalization
- Member Engagement
- Development

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U.S. Federal Regulations

- Department of Education Funding: Updated reference to ASHRAE Standard 90.1 from dated editions (1975, 1977, 1980) to the 2022 version. This change will require that projects using federal funds for school updates use the updated ASHRAE standard.
- Definition of a Zero Emissions Buildings – The Administration was responsive to ASHRAE's input and the draft definition that was released clarified that Part 1 was focused on operational emissions and referred to the ASHRAE Standard 90.1 for the high energy efficiency component of the definition.
- U.S. EPA and Department of Education references on Indoor Air Quality reference ASHRAE Standards 62.1, 62.2, and 241.
- GSA considering use of Standard 90.4 in its Minimum Requirements for Data Centers

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State laws and regulations

- Hawaii: Successfully blocked and moderated legislation that would have slowed energy code updates.
- Maryland: Successfully supported legislation that improved energy performance requirements and carbon reductions for state-owned buildings.
- Refrigerant Transitions: supported bills to align state building codes with the federal refrigerant phasedown in Massachusetts, Alaska, Pennsylvania, Wisconsin, and NJ.
- IAQ: Supported bills in Colorado, Connecticut, Massachusetts and Maryland that referenced ASHRAE Standards, including 55, 62.1 and 241, for school buildings.
- Water System Safety: Supported Pennsylvania bill improving management for risk reduction of legionnaires' disease risk that references ASHRAE Standard 188.
- Indoor smoking: Supported a New Jersey bill banning smoking in casinos, which was the first bill of its kind to be approved by the Senate Health Committee in 10 years.

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Canadian Regulations

- The Canadian federal government's 2030 Emissions Reduction Plan aims to reduce emissions from buildings by implementing updated building codes and supporting retrofitting efforts. These measures target both new construction and existing buildings, with an emphasis on transitioning to net-zero energy-ready structures. Canada has begun the process of updating the nation's model codes to a new 2025 edition from the current 2020 edition, and extra emphasis is being placed on energy efficiency, net-zero and net-zero ready structures, and greater resilience in the face of climate disasters such as wildfires and floods.

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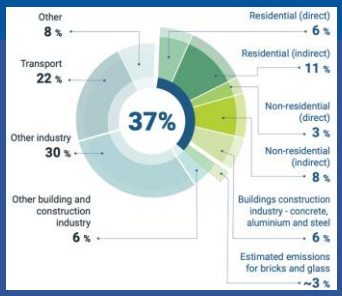
Global building sector energy-related CO_2 emissions, 2021



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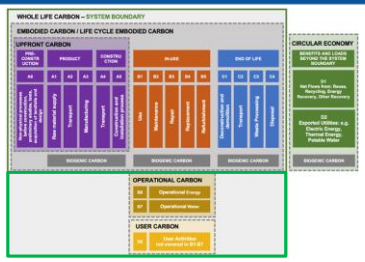
Whole Life Carbon, RICS Professional Standard, 2nd edition



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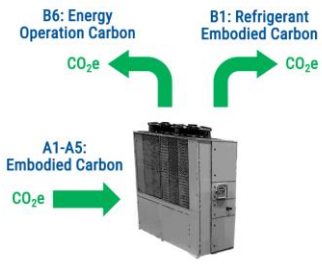
Refrigeration Equipment Greenhouse Gas Emissions

EN 15978



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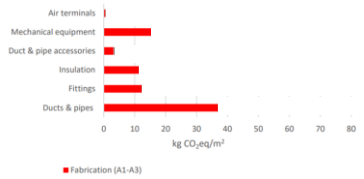
Embodied Carbon of HVAC in an office building



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ASHRAE Decarbonization Conferences

- **International Building Decarbonization 2022 Conference | Athens, Greece**: The conference provided a venue for information and idea exchange, between stakeholders in the built environment industry, concerning the timely and important topic of reducing carbon emissions from buildings. A primary goal of the conference was to bridge North American and European collaboration in decarbonization efforts
- **2023 Decarbonization Conference for the Built Environment, Washington, D.C.:** The conference focused on educating attendees on methods to decrease carbon emissions, both embodied and operational, to reduce the impact of buildings on the climate crises. The conference program addressed current and future governmental policies and regulations of which engineers, architects, owners, and operators must be aware to address environmentally responsible building requirements. The conference is organized by ASHRAE, AIA, APPA, BOMA, and IFMA

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ASHRAE Future Conference

- **ASHRAE International Building Decarbonization Conference 2024, Madrid, Sain – April 17-19, 2024:** This 3rd ASHRAE topical conference provides a unique opportunity for professionals to share information, exchange ideas and collaborate on the design, construction, ownership, and operation of facilities that have a minimal or neutral impact on the environment in terms of carbon footprint. Our primary objective is to enrich the knowledge base while fostering global collaborations in decarbonization efforts, ultimately leading to a sustainable future for our planet.

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ASHRAE Future Conference

- **2024 ASHRAE Decarbonization Conference: Decarbonizing Existing Tall Buildings, October 21-23, New York City;** will be an information and idea exchange between stakeholders in the built environment industry concerning the timely and important topic of reducing carbon emissions from existing buildings in cold climates.
- The focus for the conference will be replicable decarbonization technical solutions for existing large and tall buildings, where the density of construction makes this sector one of the most difficult to decarbonize.
- The conference will highlight substantial global activities and research driving decarbonization demonstrations, and technical and financial case studies for large building solutions.

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Building for People and Performance.
Designing for Operational Excellence.

- Designing for Operational Excellence- Intentional Design for Effective Operation and Maintenance
  - Key Components of the Guide:
    - Best-practice design processes
    - Total cost of ownership
    - Key performance indicators
    - Sustainability
    - Operator first mindset
    - Internet of Things
    - Operational analytics

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BOD | MECRealLearning

The Building Operations Designation (BOD) Program has been designed to meet the needs of the Canadian Commercial Real Estate Sector by increasing the knowledge, competencies, and skill-sets of Building Operations Professionals. Additionally, we are focused on putting a spotlight on this important occupation, positioning it as a viable and rewarding career path.

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The BOD Program consists of 22 certificates that each have 8 modules (176 total modules). Each module is approximately 30 minutes in length. All certificate and module content is accessed online and delivered in a self-paced format. The 22 certificates listed below were selected with direct input from the Commercial real estate marketplace.

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Building Operator Designation

- **Decarbonization – Pathway to Net Zero, *Operational Strategies to Reduce Emissions***
  - Module 1: Introduction to Carbon and Carbon Emissions
  - Module 2: Climate Change and Resilience
  - Module 3: Equipment, Operations and Carbon Emissions
  - Module 4: Water and Waste Programs
  - Module 5: Carbon Reducing Measures
  - Module 6: Decarbonization Roadmap
  - Module 7: Role of the Building Operations Professional
  - Module 8: Carbon Reduction Case Studies

➢https://form.jotform.com/240167543737460

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This concludes The American Institute of Architects Continuing Education Systems Course

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