

# AIA/CES SUSTAINABLE DESIGN COURSES

## DEFINING THE CRITERIA

### COTE Top Ten Measures

#### I. Sustainable Design Intent & Innovation

Sustainable design is an inherent aspect of design excellence. Projects should express sustainable design concepts and intentions, and take advantage of innovative programming opportunities.

- Key environmental issues; how and why they became important priorities
- Key ecological goals and concepts for your project and how they shaped your thinking (not a list of sustainable design measures)
- How these goals and concepts were expressed in the design
- Sustainable design innovations
- How sustainability measures led to a better overall project design
- Process of program analysis and any resource efficiencies realized by innovation

#### II. Regional/Community Design & Connectivity

Sustainable design values the unique cultural and natural character of a given region.

- How the design relates to the local context and to larger regional issues
- How the design promotes regional and community connectivity and sense of place, public space and community interaction
- Transportation policies, incentives, and other efforts to provide for those using transportation alternatives
- Site selection criteria to reduce automobile use
- How mandated parking was reduced

#### III. Land Use & Site Ecology

Sustainable design protects and benefits ecosystems, watersheds, and wildlife habitat in the presence of human development.

- How the development of the project's site responds to its ecological context, including the watershed, and air and water quality at different scales from local to regional level
- How the development of the immediate site and its buildings contribute to environmental quality
- How the design accommodates wildlife habitat preservation and creation
- How the landscape design protects or creates on-site ecosystems
- How the design responds to local development density (rural to urban) or conditions (brownfield to greenfield)

#### **IV. Bioclimatic Design**

Sustainable design conserves resources and maximizes comfort through design adaptations to site-specific and regional climate conditions. Describe how the building responds to local climate, sun path, prevailing breezes, and seasonal and daily cycles through passive design strategies.

- Site and climatic analysis
- Description of internal versus external building loads
- Design strategies that reduce or eliminate the need for non-renewable energy resources
- How these strategies specifically shaped the building plan, section, and massing
- How these strategies specifically affected placement, orientation, and shading of the building

#### **V. Light & Air**

Sustainable design creates comfortable interior environments that provide daylight, views, and fresh air.

- Design strategies for daylighting, task lighting, ventilation, indoor air quality, views, and personal control systems
- How the project's design enhances connections between indoors and outdoors
- Design team approach to integration of natural systems and appropriate technology

#### **VI. Water Cycle**

Sustainable design conserves water and protects and improves water quality.

- How building and site design strategies manage site water and drainage, and capitalize on renewable sources (such as precipitation) on the immediate site
- Water-conserving landscape and building design strategies
- Reuse strategies for water including use of rainwater, graywater, and wastewater

#### **VII. Energy Flows & Energy Future**

Sustainable design conserves energy and resources and reduces the carbon footprint while improving building performance and comfort. Sustainable design anticipates future energy sources and needs.

- How the building design reduces energy loads for heating, cooling, lighting, and water heating
- How the design and integration of building systems contributes to energy conservation and reduced use of fossil fuels, reduces green house gas emissions and other pollution, and improves building performance and comfort
- Techniques for systems integration, use of controls and technologies, efficient lighting strategies
- Use of on-site renewable and alternative energy systems

- Anticipation of future and carbon neutral fuel sources
- Strategies to reduce peak electrical demand
- How the building or parts of the building provide "passive survivability" : the ability to function in the event of power outages or interruptions in fuel supply

### **VIII. Materials & Construction**

Sustainable design includes the informed selection of materials and products to reduce product-cycle environmental impacts, improve performance, and optimize occupant health and comfort.

- Efforts to reduce the amount of material used on the project
- Materials selection criteria, considerations, and constraints, such as optimizing health, durability, maintenance, and energy use, and/or reducing the impacts of extraction, manufacturing, and transportation
- How the building enclosure will perform in relationship to air, moisture, water and thermal characteristics
- Consideration given to impacts on the environment over the full life cycle and the results of life cycle assessment if available
- Description of any "green lease" program
- Construction waste reduction plans and any strategies to promote recycling during occupancy

### **IX. Long Life, Loose Fit**

Sustainable design seeks to enhance and increase ecological, social, and economic values over time.

- How the project was designed to promote long-term flexibility and adaptability
- Anticipated service life of the project, and description of any components designed for disassembly
- Materials, systems, and design solutions developed to enhance versatility, durability, and adaptive reuse potential

### **X. Collective Wisdom & Feedback Loops**

Sustainable design strategies and best practices evolve over time through documented performance and shared knowledge of lessons learned.

- How you modeled and evaluated the design during the programming and design phases
- How you evaluated the performance of the built results
- Collaborative efforts between the design team, consultants, client, and community
- How the process enhanced the performance and success of the building
- Lessons learned during the design, construction, and occupation of the building
- How these lessons would change your approach to this project if starting over, or to future projects
- Commissioning and any on-going monitoring of building performance and occupant satisfaction

## 50>>50 Descriptions

### **1 ACTIVE SOLAR THERMAL SYSTEMS**

Active solar thermal systems use solar collectors to collect the sun's energy to heat water, another fluid, or air including solar service water, ventilation preheat and space heating.

### **2 ALTERNATIVE ENERGY**

Alternative energy is energy derived from natural sources that does not use up those sources and that has minimal environmental impact such as geothermal, wind power, hydropower and wave action generation.

### **3 ALTERNATIVE TRANSPORTATION**

Alternative Transportation includes bicycles; car sharing; electric, flexible fuel, and hybrid vehicles; hypercar; light electric vehicles: motorized bicycle; paratransit; plug-in hybrid electric vehicle (PHEV); public transportation; ridesharing/dynamic ridesharing; zero-emissions vehicle (ZEV); sustainable transportation movement; transit-oriented development; clean fleet guide; carbon offsets; walkable communities

### **4 APPROPRIATE SIZE AND GROWTH**

Appropriate Size and Growth includes the planning issues regarding urban sprawl and the smart growth movement, as well as the programming of appropriately sized individual buildings. Design spaces and services to support new functions and reuse for easy and rapid spatial change.

### **5 BUILDING FORM**

Building Form defines the space that shelters our interior human activity and the negative space, the void between building forms, shapes our exterior human activities in the built environment. It is an integrated design process to balance site/natural, economic, and programmatic building form determinants to enhance building performance. Building information modeling (BIM) and energy simulation software are used to understand and predict the effect of building form on energy use for various design concepts in the early stages of design.

### **6 BUILDING MONITORING**

Building Monitoring ensures that all building systems operate at peak efficiency. Techniques include: controls; design tools; adequately trained personnel; green building rating tools; energy policy act; and periodic recommissioning.

### **7 BUILDING ORIENTATION**

Building Orientation strongly relates a building to the natural environment – the sun, wind, weather patterns, topography, landscape, and views.

## **8 CARBON OFFSETS**

Carbon Offsets include funds used to mitigate the impacts of greenhouse gas (GHG) emissions by channeling corporations' and individuals' voluntary investments into projects that create carbon dioxide (CO<sub>2</sub>) savings equivalent to their CO<sub>2</sub> emissions.

## **9 CAVITY WALLS FOR INSULATING AIRSPACE**

Cavity Walls for Insulating Air Space applies to any layered wall system that uses an insulating air space and internal drainage plane to resist rainwater penetration.

## **10 CO-GENERATION**

Cogeneration, also referred to as combined heat and power (CHP), is the use of a heat engine or a power station to simultaneously generate both electricity and useful heat.

## **11 CONSERVING SYSTEMS AND EQUIPMENT**

Conserving Systems and Equipment include design and control strategies for efficient system operation; and equipment options for efficient systems.

## **12 CONSTRUCTION WASTE MANAGEMENT**

Construction Waste Management (CWM) minimizes and diverts construction waste, demolition debris, and land-clearing debris from disposal and redirects recyclable resources back into the construction process.

## **13 COOL ROOFS**

Cool Roof is highly reflective and emits heat it has absorbed back to the atmosphere. A roof is defined as cool based on two radiative properties: solar reflectance and thermal emittance.

## **14 DECONSTRUCTION AND SALVAGE MATERIALS**

Deconstruction and Salvage Materials - the process of taking a building apart piece by piece with the intent of recycling or salvaging as many of the building materials as possible.

## **15 DAYLIGHTING**

Daylighting is a design strategy that employs the available daytime exterior light to illuminate the interior of buildings.

## **16 EARTH SHELTERING**

Earth-sheltering structures building techniques include: benching - cutting or stepping into a slope to create building terraces or trenches; berming - piling of earth against the enclosing walls; and excavating - total or partially digging into the earth.

## **17 EFFICIENT ARTIFICIAL LIGHTING**

Efficient Artificial Lighting produces the optimum lighting level for the task while using a minimum amount of electrical energy.

## **18 EFFICIENT SITE LIGHTING SYSTEMS**

Efficient Site Lighting Systems provide the necessary level of light for visibility and safety while minimizing the amount of energy used to generate the lighting.

## **19 ENERGY MODELING**

Energy modeling is the practice of using computer-based programs to model the energy performance of an entire building or the systems within a building.

## **20 ENERGY SOURCE RAMIFICATIONS**

Energy Source Ramifications are inherent acts of construction, operations, and maintenance of the infrastructure of buildings use energy.

## **21 ENERGY-SAVING APPLIANCES AND EQUIPMENT**

Energy-Saving Appliances and Equipment apply efficiency standards in using energy-saving appliances and equipment for new construction, remodeling, or upgrading appliances and equipment in the building sector.

## **22 ENVIRONMENTAL EDUCATION**

Environmental Education increases public awareness and knowledge of environmental issues and challenges and the study of relationships between natural and human systems.

## **23 GEOEXCHANGE**

Geoexchange uses the relatively consistent temperatures of deep earth for the heating and cooling of buildings through the use of ground-source heat pumps (GSHPs), also known as geothermal heat pumps or geoexchange heat pumps. Techniques include open loop and closed loop; water to air; and water to water.

## **24 GREEN ROOFS**

Green Roofs are building roofs that are partially or completely covered with vegetation and soil, or a growing medium, planted over a waterproofing membrane. A green roof may also include additional layers such as a root barrier and drainage and irrigation systems. Green roof may also be used to refer to roofs that incorporate some form of green technology, such as solar panels or photovoltaic modules. Green roofs are also referred to as eco-roofs, vegetated roofs, living roofs, and greenroofs.

## **25 HIGH-EFFICIENCY EQUIPMENT**

High-Efficiency Equipment based on design and functionality consumes far less energy over time than conventional equipment that performs the same function.

## **26 INTEGRATED PROJECT DELIVERY**

Integrated Project Delivery integrates the knowledge and experience of designers, constructors, owners and operators in a collaborative design process to achieve high-performance buildings.

## **27 LIFE CYCLE ASSESSMENT**

Life Cycle Assessment (LCA) is a cradle-to-grave analysis and evaluation of the environmental impact of a product or service throughout its lifespan.

## **28 MASS ABSORPTION**

Mass Absorption refers to the process of storing energy in building materials commonly referred to as “thermal mass” for use at a later time.

## **29 MATERIAL SELECTION AND EMBODIED ENERGY**

Material Selection and Embodied Energy consider the immediate and long-term economic, environment, and health effects in the choice of materials. Embodied energy is a measure of the total energy consumed by a product during its life or complete life cycle.

## **30 NATURAL VENTILATION**

Natural Ventilation is an energy-efficient way to increase human comfort because air movement increases heat transfer from the skin when cooler outside air replaces warm and humid indoor air.

## **31 OPEN, ACTIVE, DAYLIT SPACE**

Open, Active, Daylit Space considers indoor environments, especially attributes such as the amount and quality of light and color, sense of enclosure, sense of privacy, access to window views, connection to nature, sensory variety, and personal control over environmental conditions.

## **32 PASSIVE SOLAR COLLECTION OPPORTUNITIES**

Passive Solar Collection Opportunities are harvesting the sun’s energy and using that energy for heating, cooling, daylighting, and water heating in buildings.

## **33 PHOTOVOLTAICS**

Photovoltaics (PV) is a technology in which sunlight is converted into electrical power.

## **34 PRESERVATION/REUSE OF EXISTING FACILITIES**

Preservation/Reuse of Existing Facilities is saving old and historic buildings, sites, structures, and objects from destruction or deterioration, and providing for their continued use by means of restoration, rehabilitation, reconstruction, or adaptive reuse.

### **35 RADIANT HEATING AND COOLING**

Radiant Heating and Cooling is radiant energy is transferred directly to occupants and objects within a space.

### **36 RENEWABLE ENERGY RESOURCES**

Renewable Energy Resources is the purchase “green” or renewable electricity generated off-site. It involves taking advantage of one of several methods to track renewable energy generation and stimulate more renewable energy-generating capacity.

### **37 RIGHTSIZING EQUIPMENT**

The Rightsizing Equipment concept is commonly applied to a building’s heating and cooling (HVAC) systems and is a fundamental element in the integrated approach to building design.

### **38 SMART CONTROLS**

Smart Controls or intelligent controls are sophisticated devices that perform multiple functions and are used for energy management, HVAC and lighting systems control, and to alert operations and maintenance (O&M) personnel of impending equipment failure.

### **39 SPACE ZONING**

Space Zoning spatial characteristics and functional requirements address design objectives – accessibility, aesthetics, cost-effectiveness, functionality, historic, productive, security/safety, and sustainability – and their interrelationships must be understood, evaluated, and appropriately applied within the spaces.

### **40 STAFF TRAINING (TECHNICAL TRAINING)**

Limited to Technical Training related to sharing lessons learned from the evaluation of prior applications, processes, procedures and decisions and how they affected the outcomes of proposed solutions.

### **41 SUN SHADING**

Sun Shading is the process of controlling the sunlight entering a building and addresses three basic categories of shading devices: landscaping, roof overhangs, and exterior or interior shading devices.

### **42 SYSTEMS COMMISSIONING**

Systems Commissioning is a quality assurance process to ensure that building systems perform as intended. Systems Commissioning refers to: HVAC systems and associated controls; lighting and daylighting controls; domestic hot water systems; and renewable energy systems. Systems Commissioning includes planning, delivery, verification, and managing risks to critical functions. Commissioning can take place during design, construction, and postoccupancy.

#### **43 SYSTEMS TUNE-UP**

Systems Tune-Up involves identifying and fixing problems in existing buildings including lighting systems; envelope; controls; boiler; and heat exchanger tune-ups.

#### **44 THERMAL BRIDGING**

Thermal Bridging occurs in building envelopes when relatively high thermal conductivity materials such as steel and concrete create pathways for heat loss that bypass thermal insulation.

#### **45 TOTAL BUILDING COMMISSIONING**

Total Building Commissioning (TBCx) is a quality assurance process to ensure that the building as a whole – all of its components and systems – performs as intended. TBCx includes the building envelope, mechanical systems, structural, electrical, control, elevators, plumbing, and life safety systems.

#### **46 VEGETATION FOR SUN CONTROL**

Vegetation for Sun Control - Plants and trees used to reduce solar gain in buildings (when not desired), reducing mechanical loads, and thereby further contributing to carbon-reducing strategies.

#### **47 WALKABLE COMMUNITIES**

Walkable Communities planned around people scaled to ensure that walking and cycling distances are convenient from home to school, work, and services. Walkable communities are scaled for sustainability of resources (both natural and economic) and locate goods (such as housing, offices, and retail) and services (such as transportation, schools, and libraries) that a community resident or employee needs on a regular basis within an easy and safe walk.

#### **48 WASTE-HEAT RECOVERY**

Waste-Heat Recovery refers to heat that is discharged as a by-product from one process to provide supplemental energy needed by another process. Typical examples of waste-heat recovery applications are preheating of combustion air, space heating, ventilation, water heating, boiler feed water, or process water.

#### **49 WATER CONSERVATION**

Water Conservation involves collecting, treating, and distributing potable water and the collection and treatment of wastewater for environmentally safe disposal back into our waterways.

#### **50 WINDOWS AND OPENINGS**

Windows and Openings are designed in a building envelope to permit the passage of air, light, vehicles, or people. Windows and openings have the greatest impact on building occupants for daylighting, ventilation, thermal comfort, acoustics, and occupant well-being.

## OTHER TOPICS

- Biomimicry
- Green Specifications
- Indoor Environmental Quality
- Prefabrication
- Contract Documents related to sustainable design
- Safety and Security Systems (defensive planting, innovative design, defensive space)
- Zoning, regulatory, codes