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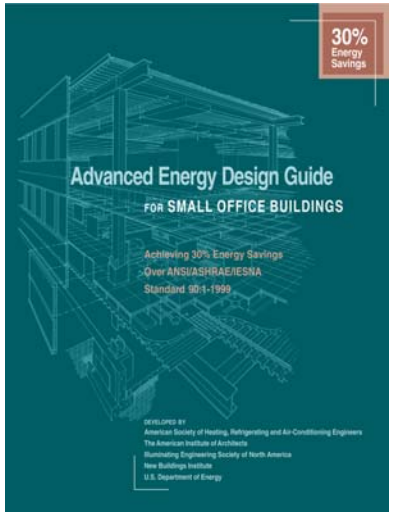
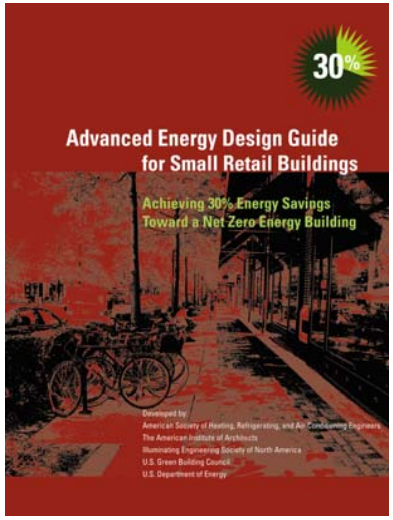
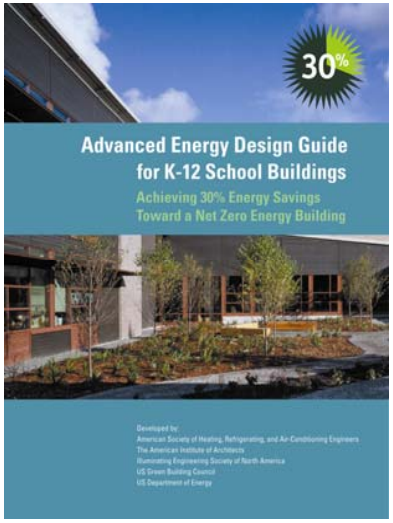
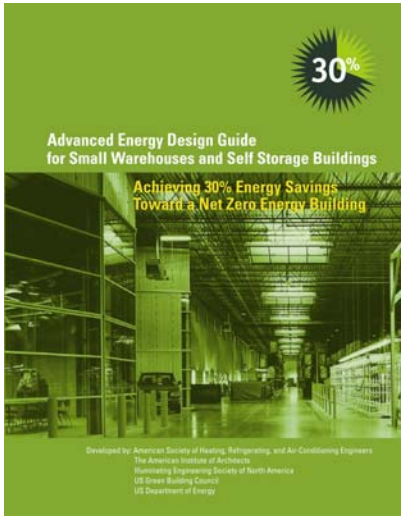
Advanced Energy Design Guides: HVAC Recommendations









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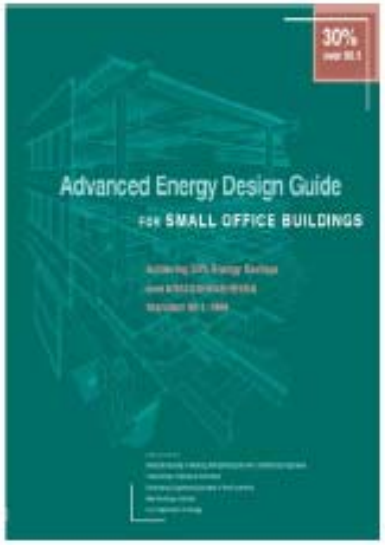

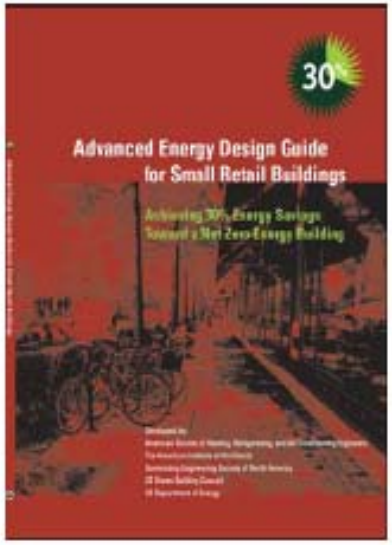

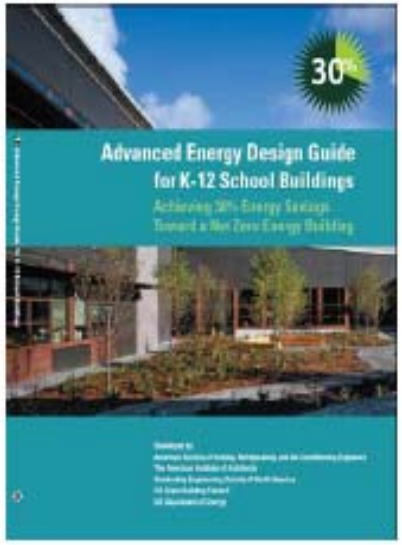

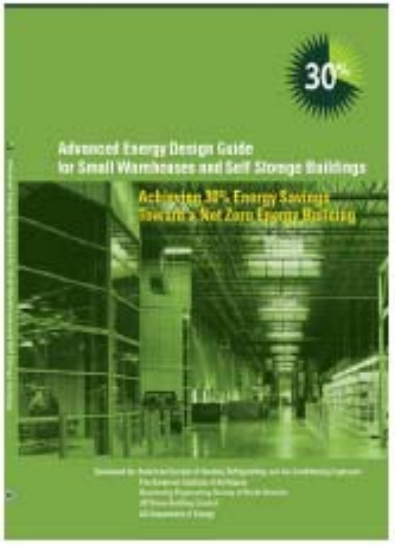

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EDUCATION
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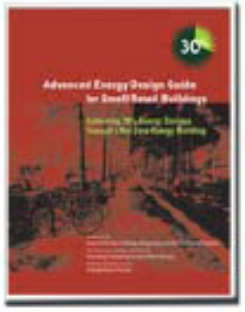
Overview/Purpose

The ASHRAE *Advanced Energy Design Guides* (AEDG) are a series of publications designed to provide recommendations for achieving energy savings over the minimum code requirements of ANSI/ASHRAE/IESNA Standard 90.1-1999. The guides have been developed in collaboration with these partnering organizations: The American Institute of Architects (AIA), the Illuminating Engineering Society of North America (IESNA), the U.S. Green Building Council (USGBC), and the U.S. Department of Energy (DOE). The New Building Institute (NBI) participated only in the development of the *Advanced Energy Design Guide for Small Office Buildings*.



The initial series of guides have an energy savings target of 30% which is the first step in the process toward achieving a net zero energy building - defined as a building that, on an annual basis, draws from outside resources equal or less energy than it provides using on-site renewable energy sources. Each 30% Guide addresses a specific building type. Additional guides for existing buildings and at 50% energy savings towards a net zero energy building are also planned.

ANSI/ASHRAE/IESNA Standard 90.1-1999, the energy conservation standard published at the turn of the millennium, provides the fixed reference point for all of the 30% Guides in this series. The primary reason for this choice as a reference point is to maintain a consistent baseline and scale for all of the 30% AEDG series documents.

The recommendations in the 30% Guides will allow those involved in designing or constructing the various building types to easily achieve advanced levels of energy savings without having to resort to

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ASHRAE

Development of the AEDGs

- Collaboration of Partner Organizations
- Management via a Steering Committee
- Volunteer team effort over a year
- Focus group for conceptual review
- 65% and 90% public reviews

Guide Goal

- Packages of recommendations that result in at least 30% energy savings when compared to ANSI/ASHRAE/IESNA Std. 90.1-1999
- Present recommendations for *some ways, but not all ways or the only way* to build energy efficient buildings
  - Provide climate specific recommendations
  - Not a code or Standard
- 30% progress toward a net zero energy building

Guide Contents

- Chapter 1 Introduction
- Chapter 2 Process for Achieving Energy Savings
- Chapter 3 Recommendations by Climate Zone
- Chapter 4 Technology Examples and Case Studies
- Chapter 5 How to Implement Recommendations
  - Quality Assurance
  - Envelope
  - Lighting
  - HVAC
  - Service Water Heating
  - Bonus Savings

Development of Recommendations

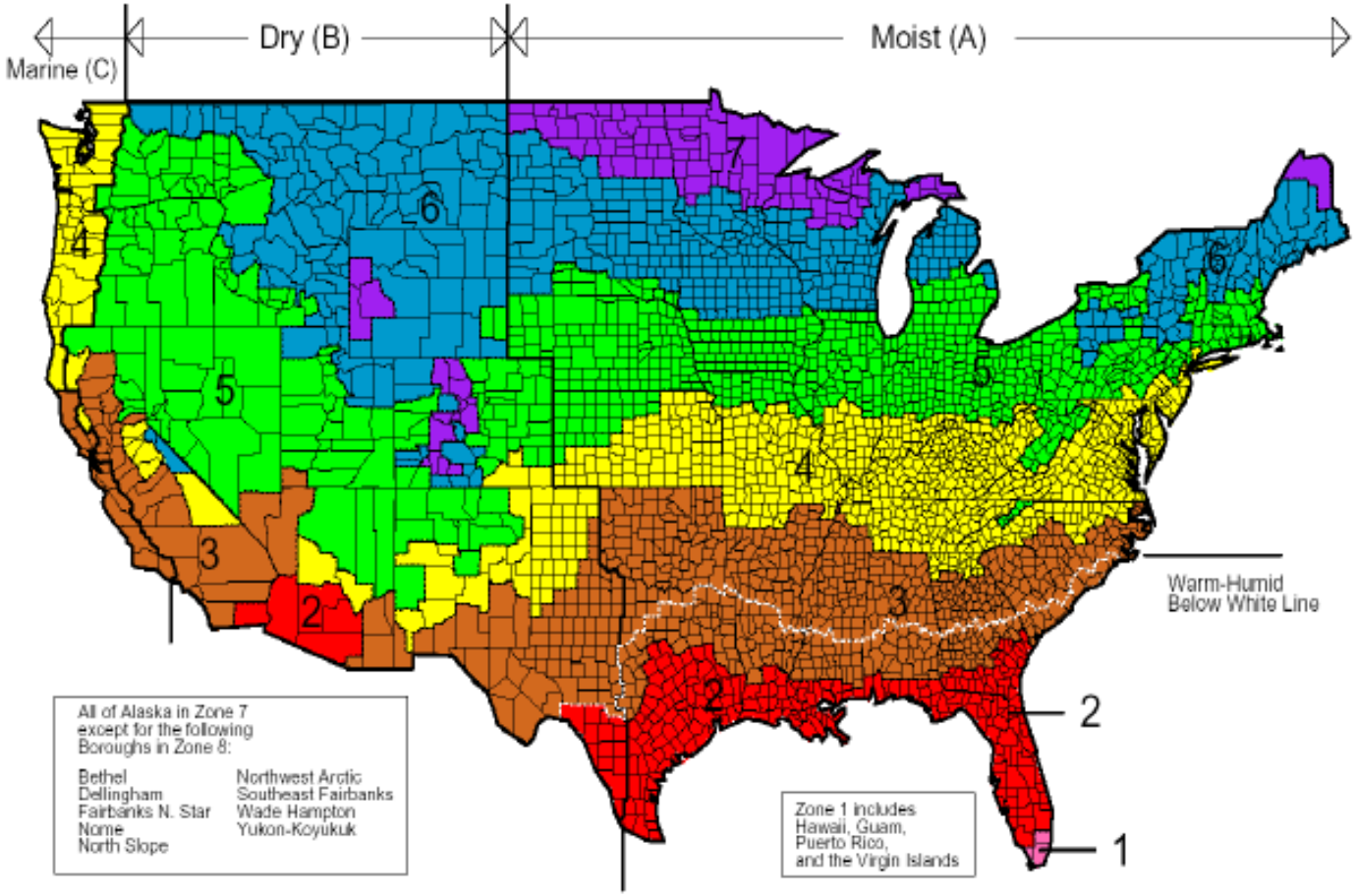
- Recommendations for envelope, lighting, HVAC, and Service Hot Water that achieve at least 30% whole building energy savings
  - Additional Savings Strategies included, but not needed for 30%
- Energy is independent variable & cost-effectiveness (e.g. payback) is dependent variable
- Recommendations modeled to verify 30% savings over ASHRAE 90.1-1999 in each climate zone
  - Site Energy Use
  - Includes “typical” plug loads (whole building energy savings)

Development of Recommendations-HVAC

- Use practical off-the-shelf technologies and strategies available from multiple manufacturers
- Provide climate specific HVAC recommendations for typical system types
- HVAC Recommendation types:
  - Heating and cooling system type
  - Heating and cooling efficiency (SEER, EER, COP, AFUE, etc)
  - Ventilation control and preconditioning
  - Economizer use
  - Fan efficiency
  - Duct design

US Climate Zones

All of the HVAC recommendations for each of the 8 climate zones are contained on a single page



Climate Zone 4 Recommendation Table

	Item	Component	Recommendation	How-To's in Chapter 4
Envelope	Roof	Insulation entirely above deck	R-20 c.i.	EN2, 17, 20-21
		Metal building	R-13 + R-19	EN3, 17, 20-21
		Attic and other	R-38	EN4, 17-18, 20-21
		Single rafter	R-38	EN5, 17, 20-21
		Surface reflectance/emittance	No recommendation	
	Walls	Mass (HC > 7 Btu/ft^2)	R-11.4 c.i.	EN6, 17, 20-21
		Metal building	R-13	EN7, 17, 20-21
		Steel framed	R-13 + R-7.5 c.i.	EN8, 17, 20-21
		Wood framed and other	R-13	EN9, 17, 20-21
		Below-grade walls	No recommendation	EN10, 17, 20-21
	Floors	Mass	R-8.3 c.i.	EN11, 17, 20-21
		Steel framed	R-30	EN12, 17, 20-21
		Wood framed and other	R-30	EN12, 17, 20-21
	Slabs	Unheated	No recommendation	EN17, 19-21
		Heated	R-7.5 for 24 in.	EN14, 17, 19-21
	Doors	Swinging	U-0.70	EN15, 20-21
		Non-swinging	U-0.50	EN16, 20-21
	Vertical Glazing	Window to wall ratio (WWR)	20% to 40% maximum	EN23, 36-37
		Thermal transmittance	U-0.42	EN25
		Solar heat gain coefficient (SHGC)	N, S, E, W - 0.46 N only - 0.46	EN27-28
		Window orientation	$(A_N * SHGC_N + A_S * SHGC_S) > (A_E * SHGC_E + A_W * SHGC_W)$	A_x–Window area for orientation x EN26-32
		Exterior sun control (S, E, W only)	Projection factor 0.5	EN24, 28, 30, 36, 40, 42 DL5-6
	Skylights	Maximum percent of roof area	3%	DL5-7, DL8, DL13
		Thermal transmittance	U-0.69	DL7, DL8, DL13
		Solar heat gain coefficient (SHGC)	0.34	DL8, DL13

Lighting	Interior Lighting	Lighting power density (LPD)	0.9 W/ft^2	EL1-2, 4, 8, 10-16
		Light source (linear fluorescent)	90 mean lumens/watt	EL4, 9, 17
		Ballast	Electronic ballast	EL4
		Dimming controls for daylight Harvesting for WWR 25% or higher	Dim fixtures within 12 ft of N/S window wall or within 8 ft of skylight edge	DL1, 9-11, EL6-7
		Occupancy controls	Auto-off all unoccupied rooms	DL2, EL5, 6
		Interior room surface reflectances	80%+ on ceilings, 70%+ on walls and vertical partitions	DL3-4, EL3
HVAC	HVAC	Air conditioner (0-65 KBtuh)	13.0 SEER	HV1- 2, 4, 6, 12, 16-17, 20
		Air conditioner (>65-135 KBtuh)	11.0 EER/11.4 IPLV	HV1- 2, 4, 6, 12, 16-17, 20
		Air conditioner (>135-240 KBtuh)	10.8 EER/11.2 IPLV	HV1- 2, 4, 6, 12, 16-17, 20
		Air conditioner (>240 KBtuh)	10.0 EER/10.4 IPLV	HV1- 2, 4, 6, 12, 16-17, 20
		Gas furnace (0-225 KBtuh - SP)	80% AFUE or E_t	HV1- 2, 6, 16, 20
		Gas furnace (0-225 KBtuh - Split)	80% AFUE or E_t	HV1- 2, 6, 16, 20
		Gas furnace (>225 KBtuh)	80% E_c	HV1- 2, 6, 16, 20
		Heat pump (0-65 KBtuh)	13.0 SEER/7.7 HSPF	HV1- 2, 4, 6, 12, 16-17, 20
		Heat pump (>65-135 KBtuh)	10.6 EER/11.0 IPLV/3.2 COP	HV1- 2, 4, 6, 12, 16-17, 20
		Heat pump (>135 KBtuh)	10.1 EER/11.0 IPLV/3.1 COP	HV1- 2, 4, 6, 12, 16-17, 20
	Economizer	Air conditioners & heat pumps - SP	Cooling capacity > 54 KBtuh	HV23
	Ventilation	Outdoor air damper	Motorized control	HV7-8
		Demand control	CO_2 sensors	HV7, 22
	Ducts	Friction rate	0.08 in. w.c./100 feet	HV9, 18
		Sealing	Seal class B	HV11
		Location	Interior only	HV9
		Insulation level	R-6	HV10
SWH	Service Water Heating	Gas storage	90% E_t	WH1-4
		Gas instantaneous	0.81 EF or 81% E_t	WH1-4
		Electric storage 12 kW	EF > 0.99 – 0.0012xVolume	WH1-4
		Pipe insulation (d<1½ in./ d≥1½ in.)	1 in./ 1½ in.	WH6

Note: If the table contains "No recommendation" for a component, the user must meet the more stringent of either Standard 90.1 or the local code requirements in order to reach the 30% savings target.

Integrated Design Concepts and HVAC

First, reduce the load:

- Siting and orientation
- Glazing
- Envelope
- Lighting/daylighting
- Plug loads

…then design an efficient HVAC system to meet *any* remaining loads

AEDGs provide a Chapter to help implement this concept

Guide Scope

- SO AEDG
  - Office Buildings up to 20,000 ft^2
- SR AEDG
  - Retail Buildings up to 20,000 ft^2
- K-12 AEDG
  - Elementary, Middle, and High Schools
- WH AEDG
  - Warehouse and Self Storage Facilities up to 50,000 ft^2

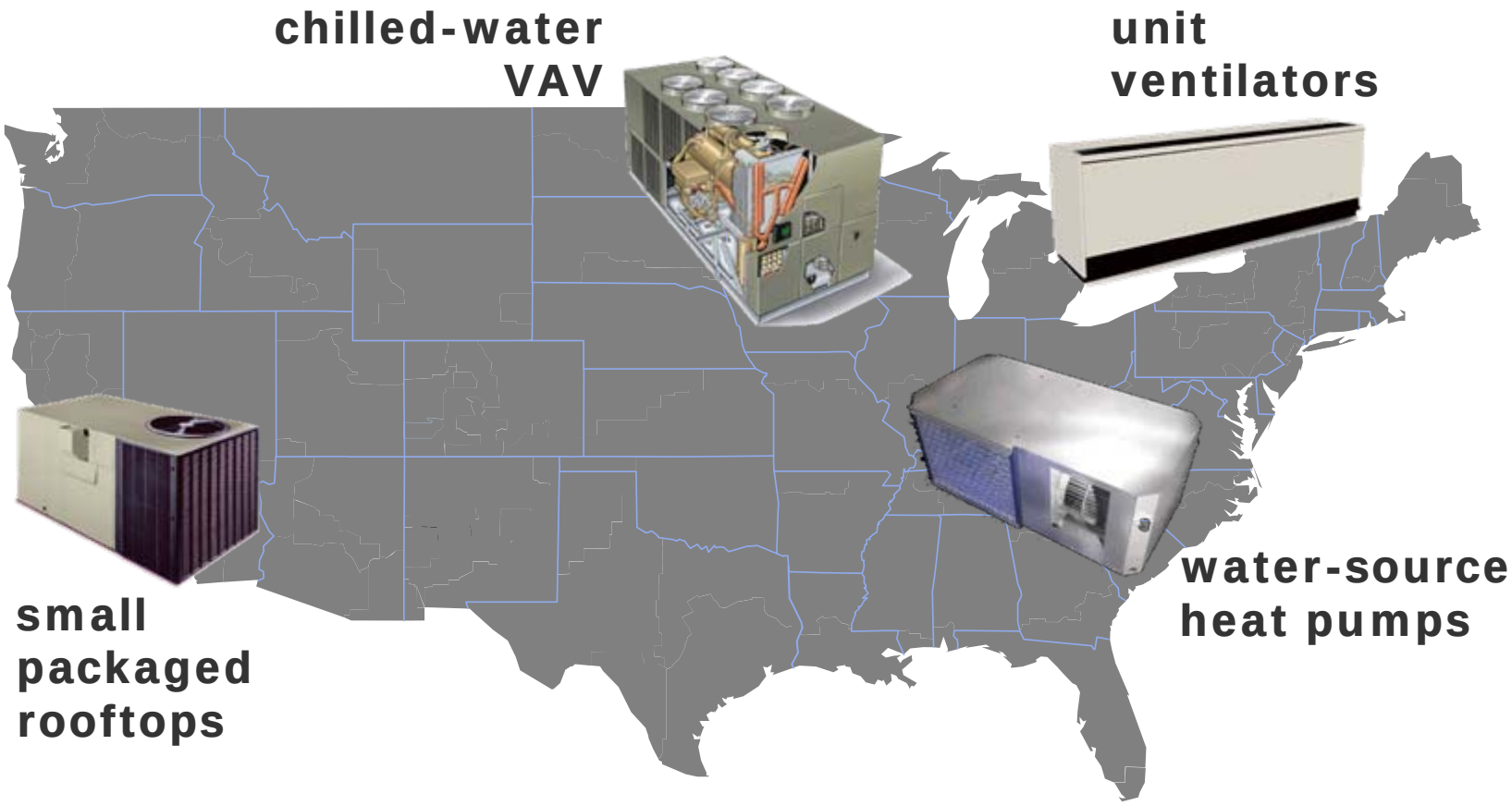
- HVAC recommendations based typical system types

prescriptive HVAC recommendations for

Small Office, Small Retail, Warehouse

prescriptive HVAC recommendations for K-12

What Type of HVAC System Typical?

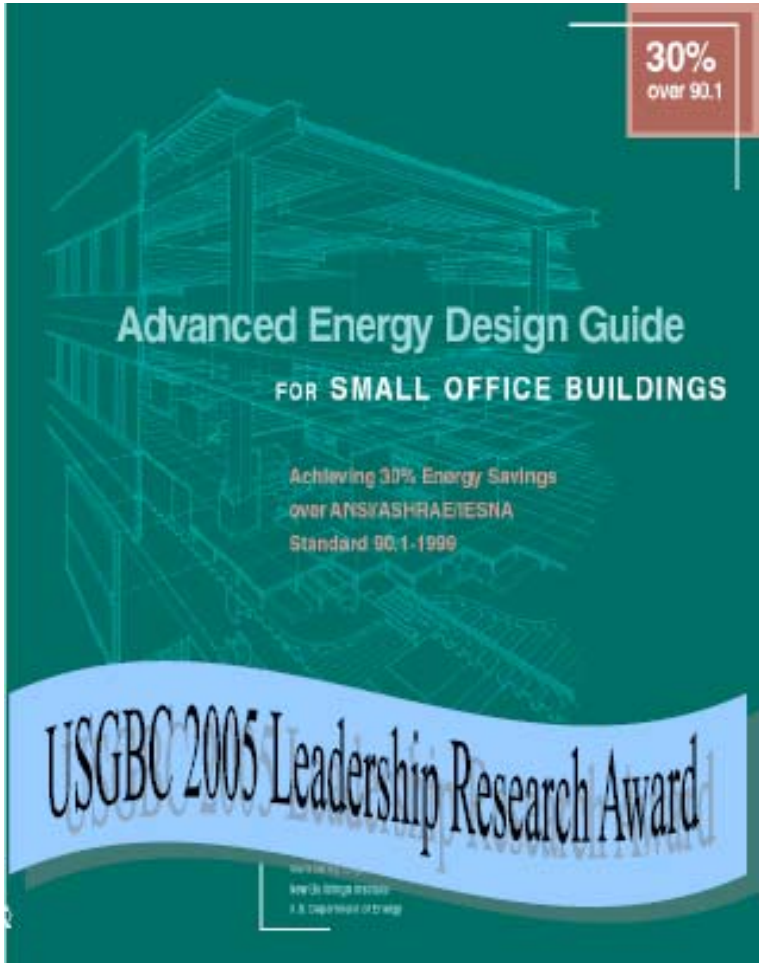


AEDG for Small Office Buildings

AEDG SMALL OFFICE

AEDG SMALL RETAIL

- First in the AEDG series
- Focuses on small offices up to 20,000 ft^2
- Split or single package roof top DX system types
- Does not apply to central plant systems
- Alternative path for 4 EA LEED credits

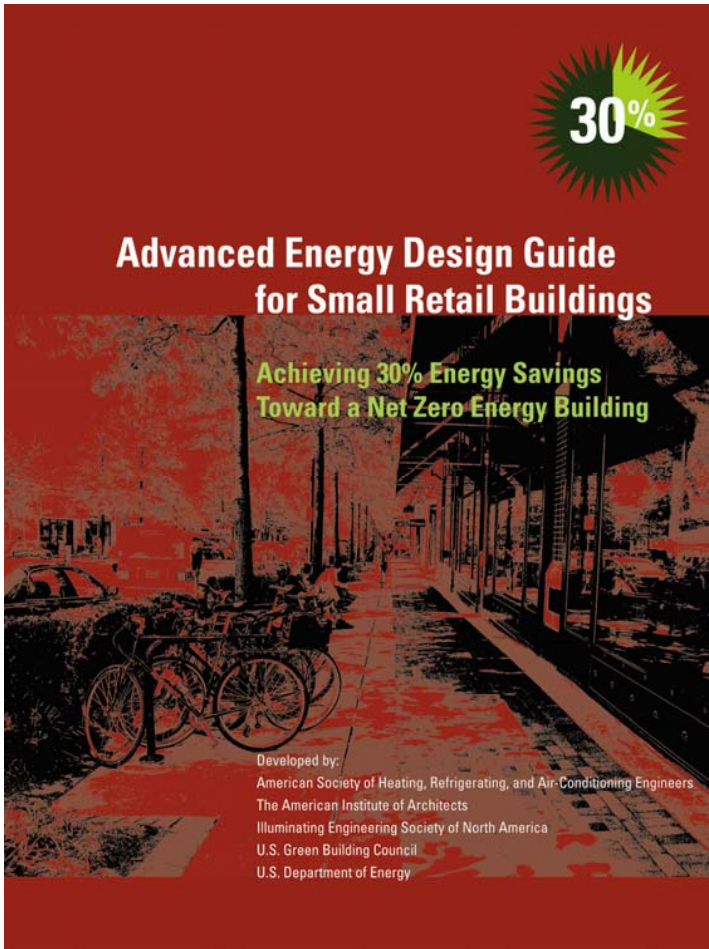


AEDG for Small Retail Buildings

AEDG SMALL OFFICE

AEDG SMALL RETAIL

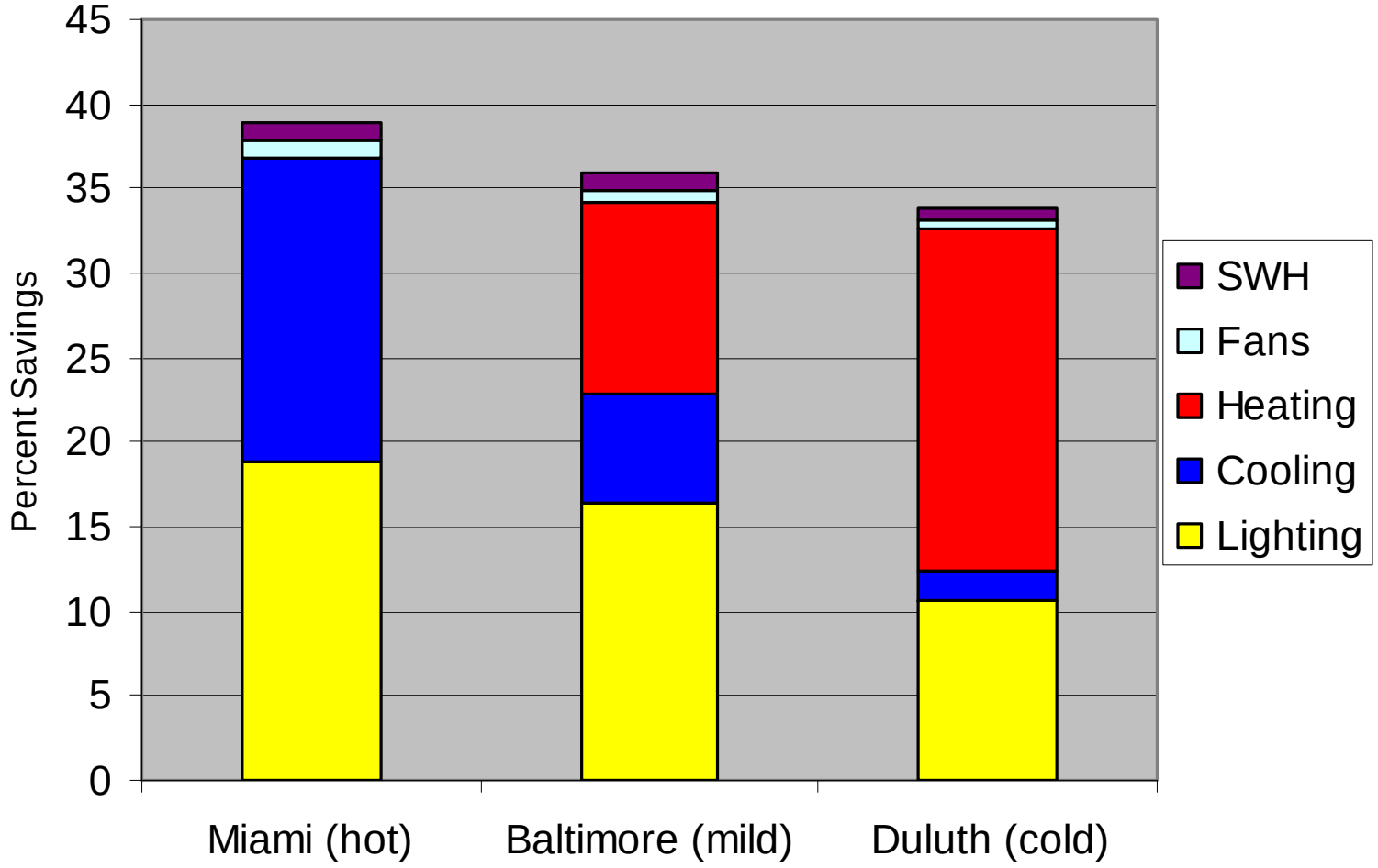
- Second in the AEDG series
- Focuses on small retail up to 20,000 ft^2
- Split or single package roof top DX system types
- Does not apply to central plant systems
- Same HVAC recommendations as Small Office AEDG, with retail specific how to's



Where is the energy saved?

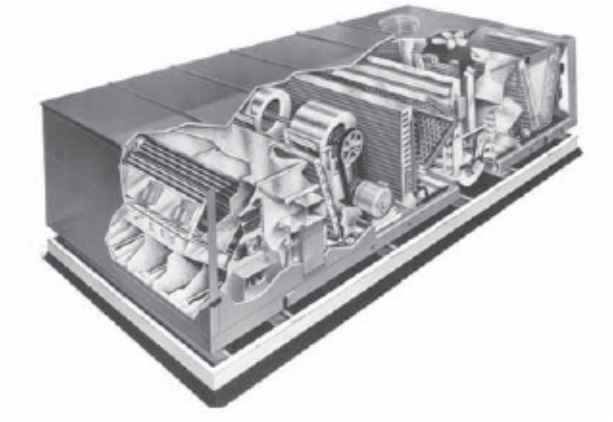
AEDG SMALL OFFICE

AEDG SMALL RETAIL



HVAC Recommendations

- Efficiency Recommendations
  - Recommendations by air conditioner size
    - 0-65 kBtuh, 65-135 kBtuh, 135-240 kBtuh, >240 kBtuh
  - Recommendations by gas furnace size and type
    - 0-225 kBtuh single package, 0-225 kBtuh split
  - Recommendations by heat pump size
    - 0-65 kBtuh, 65-135 kBtuh, >135 kBtuh



Efficiency Recommendations

AEDG SMALL OFFICE

AEDG SMALL RETAIL

- Cooling efficiencies generally higher in the hotter climates and lower in the colder climates
- Smallest equipment:
  - 13 SEER for all climate zones
  - Highest efficiencies available from multiple manufacturers

Component	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Air conditioner (0-65 KBtuh)	13.0 SEER	13.0 SEER	13.0 SEER	13.0 SEER	13.0 SEER	13.0 SEER	13.0 SEER	13.0 SEER
Air conditioner (>65-135 KBtuh)	11.3 EER 11.5 IPLV	11.3 EER 11.5 IPLV	11.0 EER 11.4 IPLV	11.0 EER 11.4 IPLV	11.0 EER 11.4 IPLV	NR	NR	NR
Air conditioner (>135-240 KBtuh)	11.0 EER 11.5 IPLV	11.0 EER 11.5 IPLV	10.8 EER 11.2 IPLV	10.8 EER 11.2 IPLV	10.8 EER 11.2 IPLV	NR	NR	NR
Air conditioner (>240 KBtuh)	10.6 EER 11.2 IPLV	10.6 EER 11.2 IPLV	10.0 EER 10.4 IPLV	10.0 EER 10.4 IPLV	10.0 EER 10.4 IPLV	NR	NR	NR

Efficiency Recommendations

AEDG SMALL OFFICE

AEDG SMALL RETAIL

- Heating efficiencies generally higher in the colder climates and lower in the warmer climates
- Split systems (Split) higher heating efficiency because these systems available from multiple manufacturers
- Single Package limited to 80% because of condensation/freezing concerns

Component	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Gas furnace (0-225 KBtuh - SP)	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et
Gas furnace (0-225 KBtuh - Split)	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	80% AFUE or Et	90% AFUE or Et	90% AFUE or Et	90% AFUE or Et	90% AFUE or Et
Gas furnace (>225 KBtuh)	80% Ec	80% Ec	80% Ec	80% Ec	80% Ec	80% Ec	80% Ec	80% Ec
Heat pump (0-65 KBtuh)	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF	13.0 SEER 7.7 HSPF
Heat pump (>65-135 KBtuh)	10.6 EER 11.0 IPLV 3.2 COP	10.6 EER 11.0 IPLV 3.2 COP	10.6 EER 11.0 IPLV 3.2 COP	10.6 EER 11.0 IPLV 3.2 COP	10.6 EER 11.0 IPLV 3.2 COP	NR	NR	NR
Heat pump (>135 KBtuh)	10.1 EER 11.5 IPLV 3.1 COP	10.1 EER 11.5 IPLV 3.1 COP	10.1 EER 11.0 IPLV 3.1 COP	10.1 EER 11.0 IPLV 3.1 COP	10.1 EER 11.0 IPLV 3.1 COP	NR	NR	NR

Outdoor Air Recommendations

AEDG SMALL OFFICE

AEDG SMALL RETAIL

- Economizers in zones 3-6 with cooling capacity above 54 kBtuh

Item	Component	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Economizer	Air conditioners & heat pumps- SP	NR	NR	Cooling capacity > 54 KBtuh	Cooling capacity > 54 KBtuh	Cooling capacity > 54 KBtuh	Cooling capacity > 54 KBtuh	NR	NR

- Demand controlled ventilation in all zones
- Interior only ducts with 0.08” w.c./100 ft in all zones

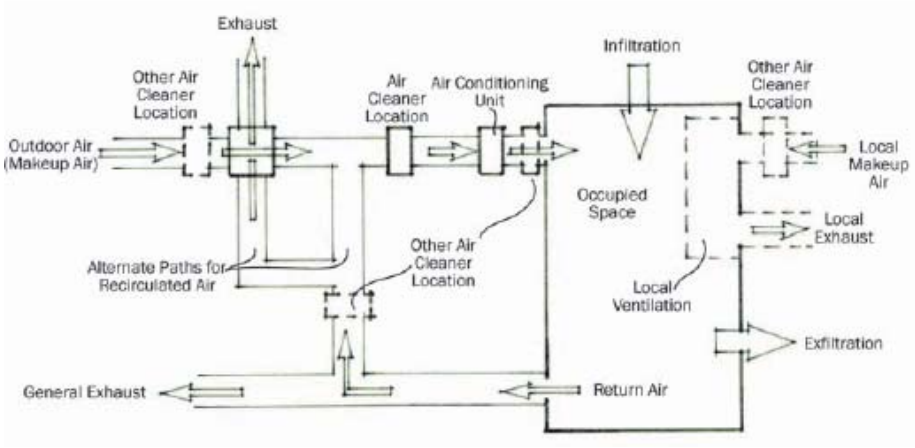
Ventilation	Outdoor air damper	Motorized control
	Demand control	CO_2 sensors
Ducts	Friction rate	0.08 in. w.c./100 feet
	Sealing	Seal class B
	Location	Interior only
	Insulation level	R-6

How to Implement (Chapter 5)

AEDG SMALL OFFICE

AEDG SMALL RETAIL

- Good Design Practice for office and retail spaces:
  - Humidity control at part load
  - Energy recovery
    - Bypass dampers
  - Ventilation air configuration
  - Ductwork distribution
  - Duct insulation and sealing
  - Control strategies to turn equipment off when not needed



- Cautions for office and retail spaces:
  - Relief fans or dampers rather than return fans
  - Noise control
  - Carbon dioxide sensor location

LEED-NC and LEED-R EAc1 Optimize Energy Performance

AEDG SMALL OFFICE

AEDG SMALL RETAIL

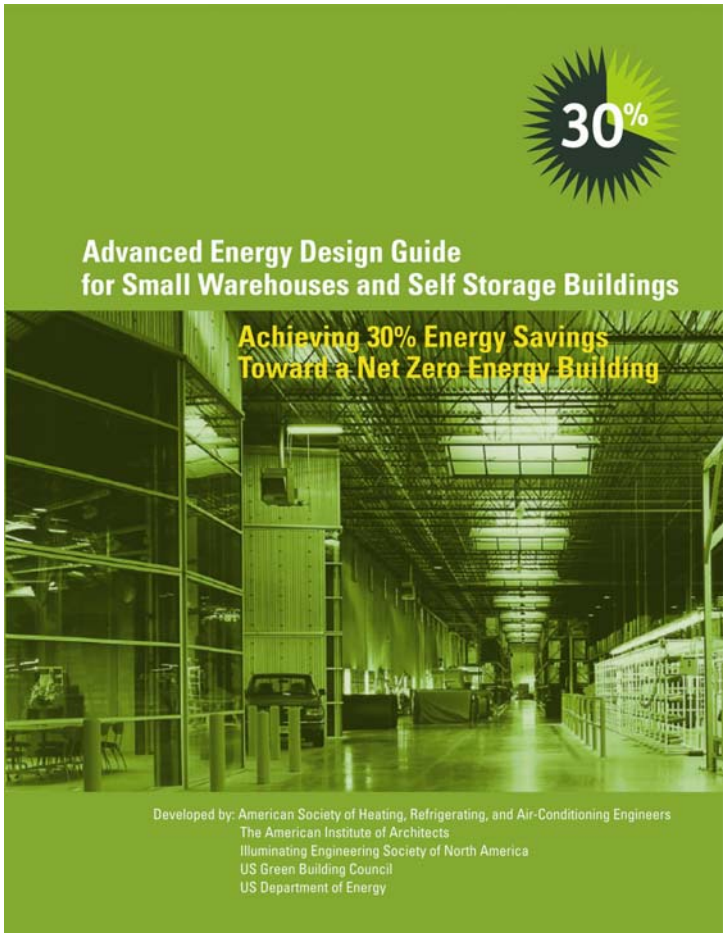
- Option 2 – Prescriptive Compliance Path (4 credits)
- Comply with the prescriptive measures of the Advanced Energy Design Guide for Small Office or Small Retail Buildings
- The following restrictions apply:
  - Buildings must be under 20,000 ft^2
  - Buildings must be office (or retail) occupancy
  - Project teams must fully comply with all applicable recommendations as established in the Advanced Energy Design Guide for the climate zone in which the building is located

AEDG for Warehouse and Self Storage

AEDG WAREHOUSE

AEDG WAREHOUSE

- Fourth in the AEDG series
- Focuses on small warehouse up to 50,000 ft^2 and self storage
- Split or single package roof top DX system types
- Does not apply to central plant systems
- Similar HVAC recommendations as Small Office AEDG, with some warehouse specific additions



AEDG Warehouse: Additional Recommendations

AEDG WAREHOUSE

- Cooling system type in Conditioned Storage spaces
  - Variable speed fan and compressor heat pump in zones 1-5
  - Maintain humidity control at part load
- Higher efficiency large furnace in zones 5-8
- Destratification fans for high bay spaces in zones 5-8
- No demand controlled ventilation recommendations

AEDG WAREHOUSE

Component	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Cooling System (Conditioned Storage all)	Heat Pump packaged systems for low sensible load spaces, Variable speed supply fan; inverter compressor					NR		
Gas furnace (>225 KBtuh)	80% Ec	80% Ec	80% Ec	80% Ec	82% Ec or 81% Et	82% Ec or 81% Et	82% Ec or 81% Et	82% Ec or 81% Et
Destratification	NR				Destratification fans for high bay spaces			

AEDG Warehouse: Additional How to Implement

AEDG WAREHOUSE

In addition to the general good design practices and cautions in the Small Office AEDG:

- Indirect gas-fired unit heaters
- Radiant slab in high infiltration spaces such as loading docks
- Ventilation rates based on product storage off-gassing
- Low leakage automatic louver dampers on exhaust fans to minimize heating season infiltration

AEDG for K-12 Schools

AEDG K-12 SCHOOLS

- Third in the AEDG series
- Focuses on elementary, middle, and high schools
- Multiple types of HVAC systems
- Typical Space types
  - Classrooms
  - Administrative
  - Corridors
  - Restrooms
  - Gyms
  - Assembly
  - Kitchen
  - Media Centers

Space types not covered

- Pools
- Wet Labs
- Wood working or Auto shop
- Field Lighting

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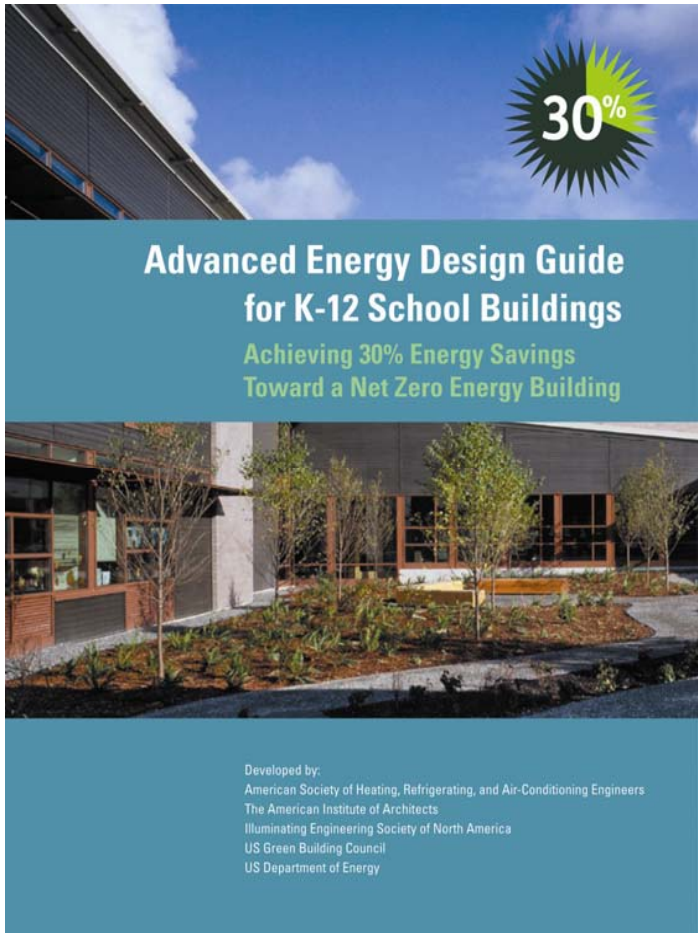

Energy Modeling Results- Daylit Elementary School

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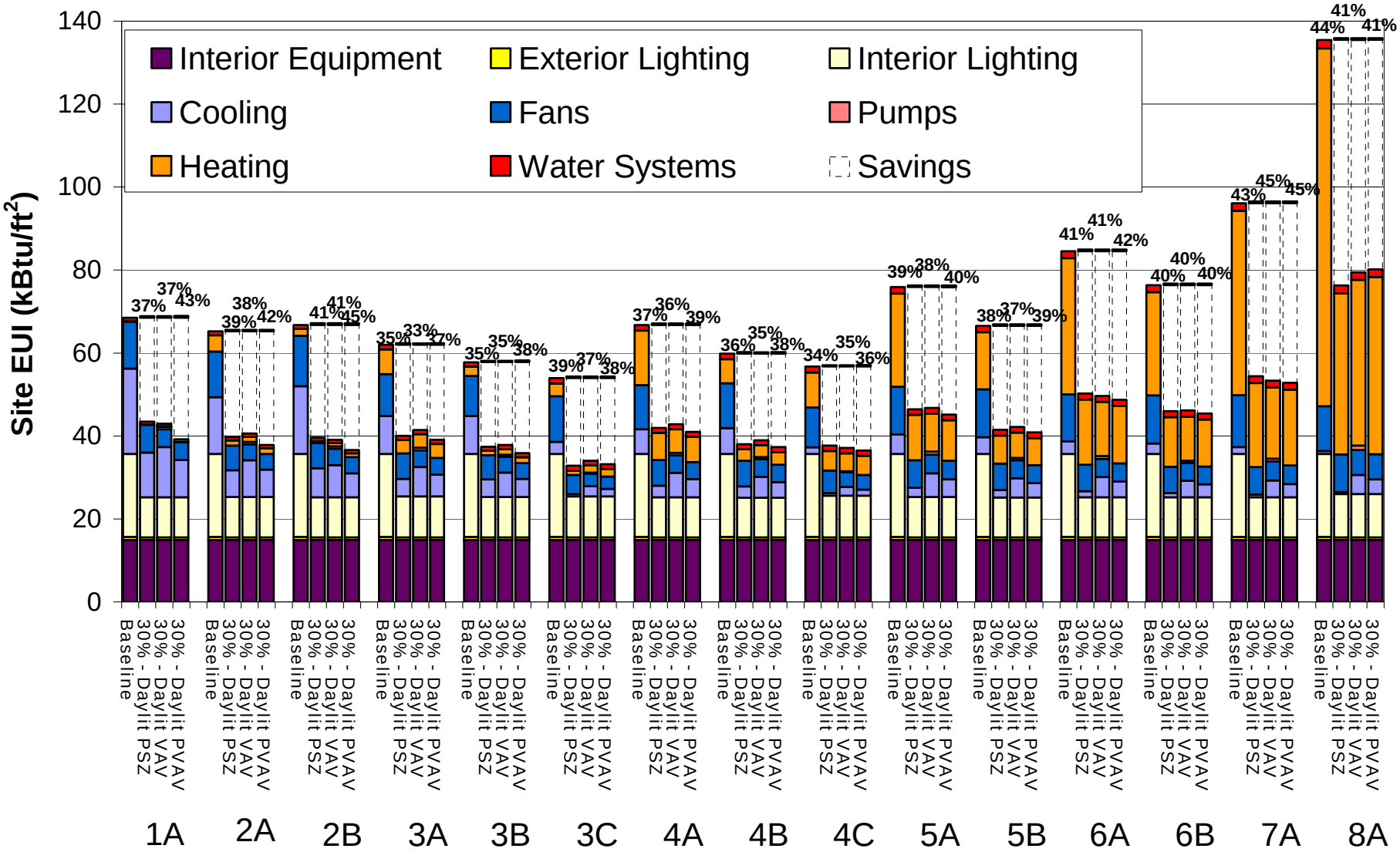

prescriptive recommendations for
Six HVAC System Types

HV-1: Single-zone, packaged DX units (or split DX systems)

HV-2: Water-source (or ground-source) heat pumps with dedicated OA system

HV-3: Unit ventilators with water chiller and boiler

HV-4: Fan coils with water chiller and boiler and dedicated OA system

HV-5: Multiple-zone, VAV packaged DX rooftop units

HV-6: Multiple-zone, VAV air handlers with water chiller

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climate-specific and system-specific

Recommendation Tables

Climate Zone 2 Recommendation Table for K-12 Schools

	Item	Component	Recommendation	How-To Tip	✓
HVAC	Packaged DX Rooftops (or DX Split Systems)	Heat pump (≥65 and <135 kBtu/h)	10.6 EER/3.2 COP	HV1, HV7–8, HV10	
		Heat pump (≥135 kBtu/h)	10.1 EER/11.5 IPLV/3.1 COP		
		Gas furnace (<225 kBtu/h)	80% AFUE or E_t		
		Gas furnace (≥225 kBtu/h)	80% E_c		
		Economizer	Comply with Standard 90.1*	HV13	
		Ventilation	Energy recovery or demand control	HV9, HV11–12, HV14	
		Fans	Constant volume: 1 hp/1000 cfm Variable volume: 1.3 hp/1000 cfm	HV19	
	WSHP System	Water-source heat pump (<65 kBtu/h)	Cooling: 12.0 EER at 86°F Heating: 4.5 COP at 68°F	HV2, HV7–8, HV10	
		Water-source heat pump (≥65 kBtu/h)	Cooling: 12.0 EER at 86°F Heating: 4.2 COP at 68°F		
		GSHP (<65 kBtu/h)	Cooling: 14.1 EER at 77°F and 17.0 EER at 59°F Heating: 3.5 COP at 32°F and 4.0 COP at 50°F	HV2, HV7–8, V10, AS4	
		GSHP (≥65 kBtu/h)	Cooling: 13.0 EER at 77°F and 16.0 EER at 59°F Heating: 3.1 COP at 32°F and 3.5 COP at 50°F		
		Gas boiler	85% E_c	HV2, HV7, HV10	
		Economizer	Comply with Standard 90.1*	HV13	
		Ventilation	DOAS with either energy recovery or demand control	HV9, HV11–12, HV14	
		WSHP duct pressure drop	Total ESP < 0.2 in. H_2O	HV19	
	Unit Ventilator and Chiller System	Air-cooled chiller efficiency			
		Water-cooled chiller efficiency			
		Gas boiler			
		Economizer			
		Ventilation			
		Pressure drop			
	Fan Coil and Chiller System	Air-cooled chiller efficiency			
		Water-cooled chiller efficiency			
		Gas boiler			
		Economizer			
		Ventilation			
		Pressure drop	Total ESP < 0.2 in. H_2O	HV19	

Unique recommendations are included for each HVAC system type in the climate-specific tables (Chapter 3)

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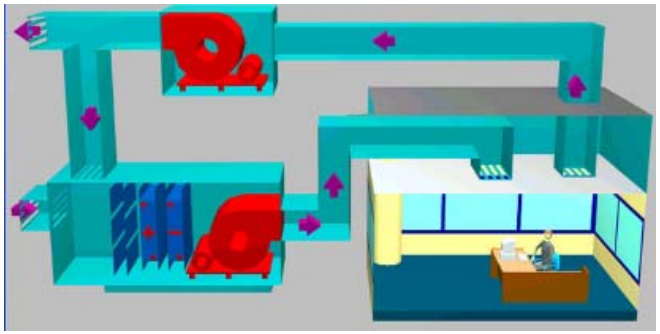
HVAC Equipment Efficiencies

Recommended efficiencies based on:

- Climate zone
- HVAC system type
- System size (capacity)
- Fuel type (electricity or natural gas)



Item	Component	Recommendation	How-To Tip	✓
Packaged DX Rooftops (or DX Split Systems)	Air conditioner (<65 kBtu/h)	13.0 SEER	HV1, HV7–8, HV10	
	Air conditioner (≥65 and <135 kBtu/h)	11.0 EER		
	Air conditioner (≥135 and <240 kBtu/h)	10.8 EER		
	Air conditioner (≥240 kBtu/h)	10.0 EER and 10.4 IPLV		
	Heat pump (<65 kBtu/h)	13.0 SEER/7.7 HPSF		
	Heat pump (≥65 and <135 kBtu/h)	10.6 EER/3.2 COP	HV1, HV7–8, HV10	
	Heat pump (≥135 kBtu/h)	10.1 EER and 11.0 IPLV/3.1 COP		
	Gas furnace (<225 kBtu/h)	80% AFUE or E_t		
	Gas furnace (≥225 kBtu/h)	80% E_c		
	Economizer	>54 kBtu/h	HV13	
	Ventilation	Energy recovery or demand control	HV9, HV11–12, HV14	
	Fans	Constant volume: 1 hp/1000 cfm Variable volume: 1.3 hp/1000 cfm	HV19	

for climate zone 5

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Good Design Practice

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Load calculations

Dehumidification

Energy recovery

Equipment efficiencies

Ventilation air

Dedicated OA systems

Economizer

Demand ventilation

Exhaust air systems

Fan motor efficiencies

System-level controls

Chilled-water system

Hot-water heating

Thermal zoning

Filters

Duct design, construction

Duct insulation

Duct sealing, leak testing

Air balancing

Commissioning

Relief versus return fans

Heating sources

Noise control

Proper maintenance

Zone temperature control

Operable windows

Ventilation Air

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Determine based on ASHRAE 62.1

- Use actual occupancy for calculations, not egress (exit) population
- Use population diversity (D) when using multiple-zone recirculating systems
- Use time-of-day schedules to introduce ventilation air only when a zone is expected to be occupied

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HV9 or HV14

Energy Used to Condition OA

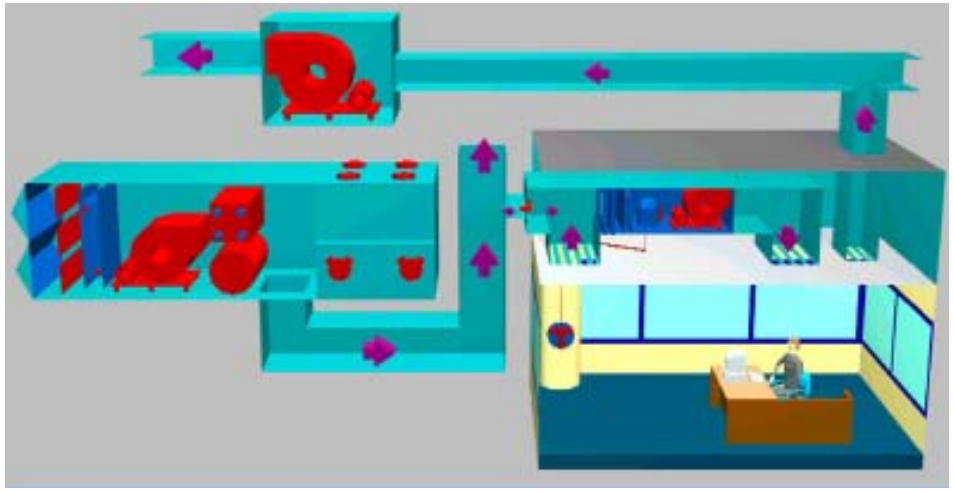
Climate Zone 2 Recommendation Table for K-12 Schools

	Item	Component	Recommendation	How-To Tip	✓
HVAC	Packaged DX Rooftops (or D	Heat pump (≥65 and <135 kBtu/h)	10.6 EER/3.2 COP	HV1, HV7–8, HV10	
		Heat pump (≥135 kBtu/h)	10.1 EER/11.5 IPLV/3.1 COP		
		Gas furnace (<225 kBtu/h)	80% AFUE or E_t		
		Gas furnace (≥225 kBtu/h)	80% E_c		
		Economizer	Comply with Standard 90.1*	HV13	
		Ventilation	Energy recovery or demand control	HV9, HV11–12, HV14	
		Fans	Constant volume: 1 hp/1000 cfm Variable volume: 1.3 hp/1000 cfm	HV19	
	WSHP System	Water-source heat pump (<65 kBtu/h)	Cooling: 12.0 EER at 86°F Heating: 4.5 COP at 68°F	HV2, HV7–8, HV10	
		Water-source heat pump (≥65 kBtu/h)	Cooling: 12.0 EER at 86°F Heating: 4.2 COP at 68°F		
		GSHP (<65 kBtu/h)			
		GSHP (≥65 kBtu/h)			
		Gas boiler			
		Economizer			
		Ventilation			
		WSHP duct pressure drop			
	Unit Ventilator and Chiller System				
		Air-cooled chiller efficiency			
		Water-cooled chiller efficiency			
		Gas boiler			
		Economizer			
		Ventilation			
		Pressure drop			
	Fan Coil and Chiller System	Air-cooled chiller efficiency			
		Water-cooled chiller efficiency			
		Gas boiler			
		Economizer	Comply with Standard 90.1*	HV13	
		Ventilation	DOAS with either energy recovery or demand control	HV9, HV11–12, HV14	
		Pressure drop	Total ESP < 0.2 in. H_2O	HV19	

Because conditioning OA for ventilation is such a big contributor to energy use in K-12 schools, <u>either</u> exhaust-air energy recovery or demand-controlled ventilation (DCV) is recommended

Part-Load Dehumidification

- Strategies to minimize cycling of constant speed fans
- Design system to minimize number of hours that space relative humidity remains above 60%
- Recommends methods for improving part-load dehumidification
  --refers to several strategies (by HVAC system type)



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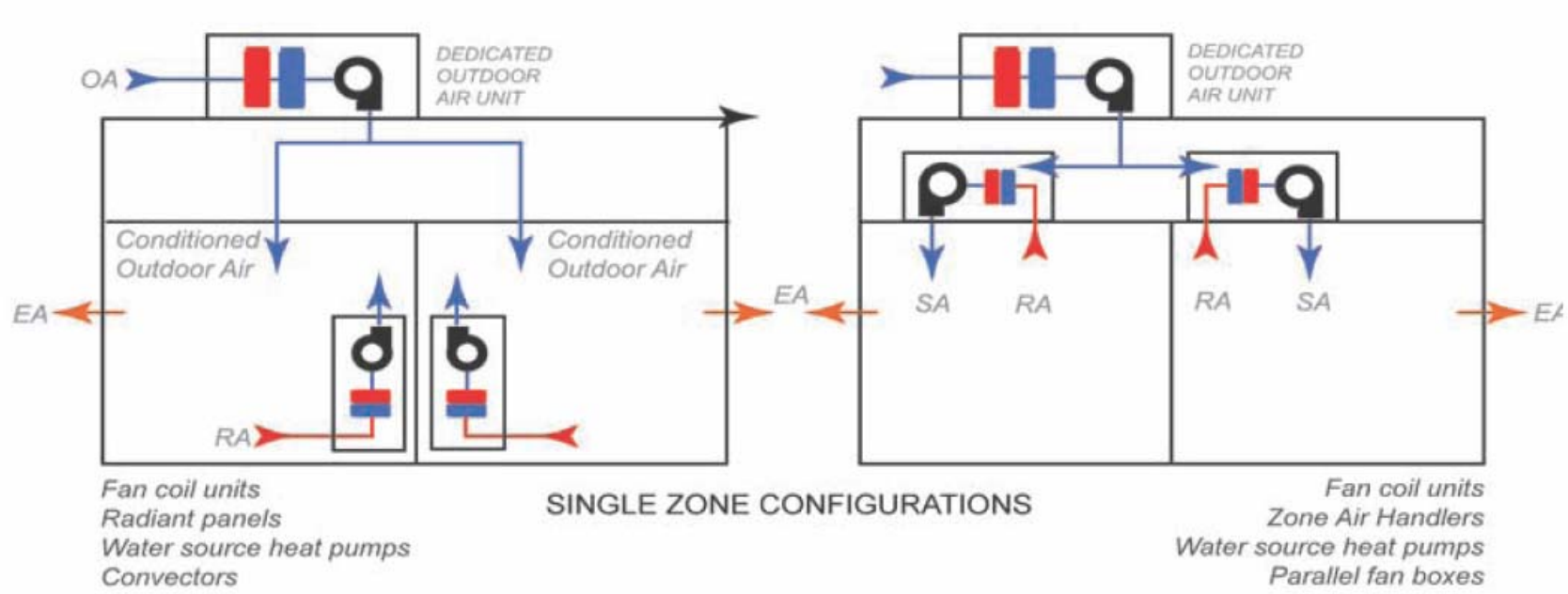
HV-12

Dedicated OA Systems



DOAS with energy recovery recommended for WSHP, fan coil, and as an option for unit ventilators

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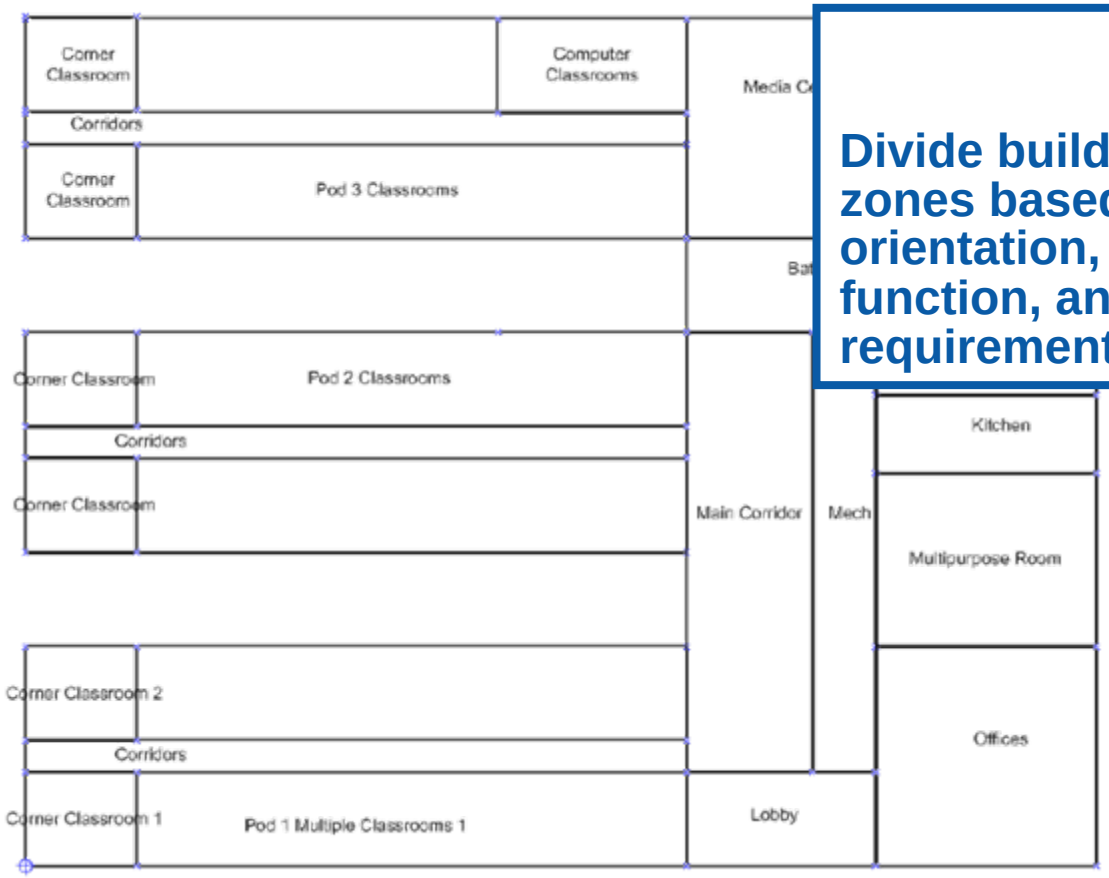
HV-20

Thermal Zoning



Divide building into thermal zones based on building size, orientation, space layout and function, and after-hours use requirements

Thermal Zoning (continued)

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For multiple-zone systems, avoid using a single air handler to serve zones with significantly different occupancy patterns

- Use multiple air handlers so those serving unused areas of the building can be shut off when not in use

  or

- Use BAS to define separate operating schedules for different areas of the building, and shut off airflow to unused areas

Proper Maintenance

Neglecting preventive maintenance practices can quickly negate any energy savings expected

- Filters should be replaced regularly
- ERVs need to be cleaned periodically
- Dampers, valves, louvers, and sensors must all be periodically inspected and calibrated
- Need asset management strategies

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LEED-Schools EAc1 Optimize Energy Performance

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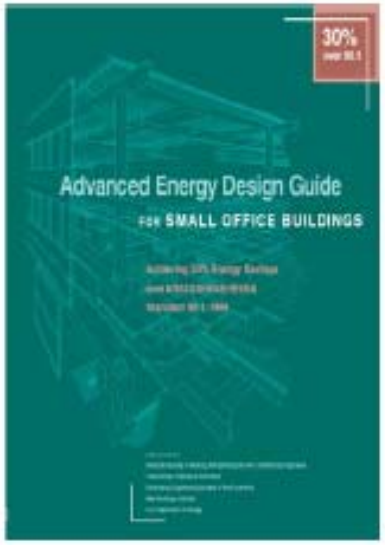
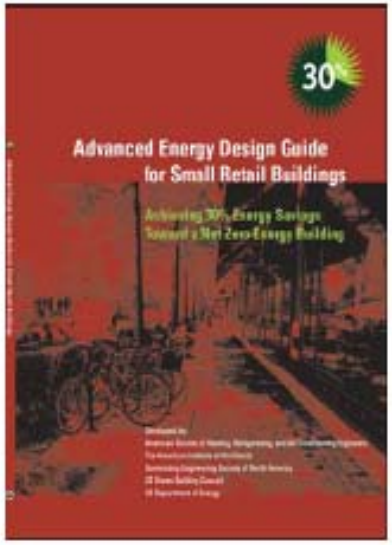
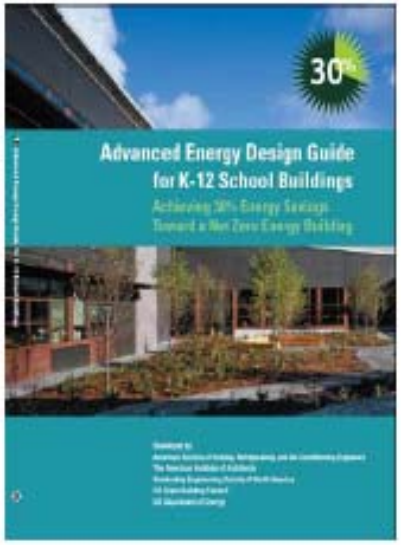
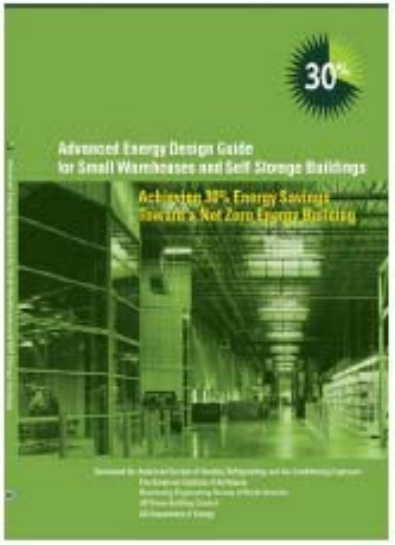
- Option 2 – Prescriptive Compliance Path (4 credits)
- Comply with the prescriptive measures of the Advanced Energy Design Guide for K-12 School Buildings
- The following restrictions apply:
  - Buildings must be under 100,000 ft^2
  - Buildings must be include the typical spaces covered under the scope
  - Project teams must fully comply with all applicable recommendations as established in the Advanced Energy Design Guide for the climate zone in which the building is located

Future Guides

- Advanced Energy Design Guide for Highway Lodging – 30% savings
  - Just completed 90% review
- Advanced Energy Design Guide for Healthcare Facilities – 30% savings
  - Just starting
- Advanced Energy Design Guides for 50% savings – Planned:
  - K-12 Schools
  - Big Box Retail
  - Small Office
  - Small Retail

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