# ENERGY DESIGN GUIDELINE

**Wisconsin Department of Administration**
**Division of Facilities Development (DFD)**
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## I. Introduction

This guideline is intended to reduce the use of fossil fuels in state owned facilities without adversely affecting program operations. Recognizing that the greatest cost of owning state facilities over their lifetime is the cost of energy to heat, cool, light and operate them, DFD expects project designs to:

1. Incorporate environmentally responsible and sustainable concepts and practices into the planning, design and construction, as described in the State's sustainable design guidelines.
2. Achieve the highest energy efficiency and lowest energy consumption that life-cycle costing will justify;
3. Incorporate the most energy-efficient materials, products, equipment and systems consistent with program and budget;
4. Incorporate renewable energy technologies at the earliest possible stages of design whenever they are technically and economically feasible;
5. Consider the impact on the utility infrastructure of the existing building/institution;
6. Utilize an integrated design approach with all disciplines working together from conceptual design on, to evaluate the energy performance of architectural design concepts (e.g.: orientation, massing, fenestration, treatment of façade, materials, insulation), mechanical and electrical design criteria and concepts to produce high performance buildings with low first costs and operating costs.

## II. Buildings

**General:** Integrate building design with mechanical and electrical design to reduce building energy consumption (Reference ASHRAE 2011 Applications, Chapter 58). Work cooperatively as a team using building modeling and life cycle cost analysis (Guidelines for Life-Cycle Costing on State Building Projects) to evaluate and revise the basic building concepts such as orientation, massing, envelope, materials, fenestration, shading, space programming and finishes to minimize heating, cooling, lighting and electrical requirements and energy consumption. Periodically collaborate in design team peer review during conceptual, preliminary and construction document phases of design to re-evaluate energy use and achieve an integrated energy conserving design.

**Programming:** Group occupancies and functions based on operating schedules and ventilation requirements to allow zoning of mechanical and electrical systems for minimum equipment and fixture operating hours.

**Envelope:** Design for low infiltration and highest practical insulation values. Detail envelope structural penetrations, soffits, window and door openings, pipe and conduit penetrations for low air infiltration and

high weather resistance. Specify Low E double or triple glazing with low shading coefficient. Reference Daylighting Standards for State Facilities.

**Finishes and Furnishings:** Use light colors for better illumination at lower lighting levels.

**Landscaping:** Select shade trees and shrubbery adjacent to buildings for reduction of cooling loads. Select plantings for minimal watering. Minimize turf areas and select native species. Specify mulches for plantings to retain soil moisture.

**Equipment (Food Service, Lab, Process, Refrigeration, etc.):** Select and specify water and energy consuming equipment to minimize water use and maximize energy efficiency. This includes vehicle/pedestrian equipment, security/detention equipment, commercial equipment, residential equipment, food service equipment, educational/scientific equipment, entertainment equipment, athletic equipment and healthcare equipment. Equipment shall meet or exceed efficiencies in the following standards unless determined to not be life-cycle cost effective or technically feasible:

1) U.S. E.P.A. Energy Star
2) U.S. D.O.E. Federal Energy Management Program (FEMP)
3) ASHRAE 90.1

Do not use domestic water for heat rejection.

**Renewable Energy:** All projects are to make maximum use of passive solar energy (typically smaller external load dominated buildings) and daylighting (Daylighting Standards for State Facilities). The design of all state facilities will, to the fullest extent possible, incorporate natural lighting, to replace the need for electric lighting during daytime hours. Use geothermal technologies for space and water heating systems where technically and economically feasible.

Projects over $500,000 are expected to make maximum practical use of active solar heating and renewable electric generation from solar thermal or photovoltaic systems, wind power, geothermal technology, biomass, fuel cells using renewable fuel or tidal or wave action and small hydro when technically and economically feasible.

## III. Plumbing Systems

**Water Conservation:** Specify low flow fixtures (0.5 GPM lavatories/lab sinks/kitchenettes aerators, 1.5-2.2 GPM showerheads, 1.28-1.6 gallon/flush water closets, 0.25-0.5 gallon/flush urinals, 1.0-1.6 GPM foodservice prerinse sprayhead). Specify water conserving dishwashers and clothes washers. Do not use domestic water for heat rejection, heating or cooling purposes.

**Pumping:** Specify control to shut down domestic hot water recirculating pumps when unoccupied.

## IV. Heating, Ventilating and Air Conditioning (HVAC)

**General:** For projects over $500,000 and for other projects as required by the DFD Project Manager, provide life cycle cost analysis (Guidelines for Life-Cycle Costing on State Building Projects) of building heating, air conditioning and domestic water heating systems taking into account first cost, energy cost, maintenance cost, replacement cost, annual recurring and non-annual costs. Select system and equipment types for lowest operating cost.

Do not use domestic water for heat rejection except as an emergency backup to another system.

**Ventilation and Air Conditioning:** Design to shut down as much equipment as possible when not needed or during unoccupied hours. Incorporate occupancy sensor zone controls to shut down terminal units and reduce overall ventilation air when unoccupied. Zone large single use spaces such as auditoriums, gymnasiums, lecture halls, etc. on single unit. Use hot water and steam heating systems, rather than air handling systems, for unoccupied temperature maintenance during the heating season wherever feasible.

Design air and water distribution systems and components to minimize pressure losses and fan and pump motor sizing.

Do not air condition swimming pools, mechanical/electrical rooms, unoccupied storage spaces (except food and drug storage), correctional facility inmate areas, state park toilet/shower facilities, vehicle service and storage buildings, industrial/shop occupancies, utility buildings, wastewater treatment plants and similar areas. Non-program revenue food service and laundry occupancies may only be cooled to 80°F.

**Gas and Oil Burning Equipment:** Select for highest thermal efficiency appropriate for application. Consider use of waste oil unit heaters in service garages where appropriate.

**Building Automation Systems and Controls:** Use reset schedules to minimize energy use for discharge air temperature control, heating hot water temperature and humidification setpoints.

## V Lighting and Electrical Systems

Reference the following design guideline and standard for electrical systems and lighting:
Electrical System Standards and Design Guidelines
Daylighting Standards for State Facilities.

## VI Additional Information

Additional energy use related guidelines beneficial to designers can be found at:
DOA/DFD Energy Use Policy
Energy Cost Reduction Plans.
Sustainable Facilities Policy and Guidelines

**End of Energy Design Guideline**