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TRF Energy's Guidelines for Energy Efficient Construction

In most construction projects, whether for a new building, a building addition or a major renovation, there are thousands of issues that must be resolved by the building owner, the design professionals and the construction contractors. A large number of these issues deal with the design, selection and integration of the building's energy systems (the building shell or envelope, the heating/ cooling/ventilation systems, lighting and the other energy-consuming equipment and appliances). Typically these issues get very little attention in the design process. This is a serious and costly mistake because, over the life of a building, the operating costs of these energy systems will exceed the initial capital costs. TRF is committed to helping its clients design comfortable and efficient buildings and has prepared this document to educate clients about good energy design standards and practices.

There are two primary reasons that building energy questions are mishandled in the design process. The first is that these issues are quite technical and involve parts of the building most people rarely see, so building owners rarely raise questions about these issues. As a result, the various professionals involved in the design process operate without meaningful oversight in the design of the building shell, HVAC, lighting and other energy-consuming systems. Each wants to avoid any future complaints or liability, so they frequently over-size or over-engineer their work, which condemns the owner to high energy bills. The best performing buildings today were designed with an integrated and iterative design approach in which all of the design professionals worked together with energy efficiency as one of their goals. A building's systems interact in synergistic ways, so good design can only come from a design process that is interactive as well. Such integrated design can lower not only the operating cost of the building, but the initial cost as well. For example, if the lighting, windows, and plug loads are made more energy efficient, the HVAC system can be downsized. The savings from smaller HVAC equipment can often pay for the "extra cost" of the energy efficiency measures. To take advantage of these synergistic opportunities, all parties should work together beginning early in the design phase to address the energy efficiency of the building.

The second reason building energy issues are mishandled in the design process is that there is usually too much focus on initial or first costs, rather than a life cycle costing analysis which takes into account the initial cost and all of the costs associated with operating and maintaining the building during its useful life. Using lighting as an example, the cost of the fixtures and lamps represents less than ten percent of the cost of lighting. The remainder of the cost of lighting is the cost of electricity and the labor costs of maintenance. To make economic decisions on the basis of the fixture cost alone is an obvious mistake, but one too many still make. The most cost-effective time to incorporate energy efficiency into a building is during construction. Since new building systems (lighting, heating, cooling and envelope) are being purchased, the energy savings need only pay back the incremental cost difference between a "standard" system and a more efficient one. Unless the design team evaluates alternative options on a life-cycle cost basis, sound decisions cannot be made.

Compared to buildings built a generation ago, today's standard construction practices typically yield a more energy efficient building. However, compared to what is economically justified and technically possible using commercially-available products and equipment, the typical new building is an energy hog. Pennsylvania recently adopted a statewide building code that incorporates the International Energy

Code, but compliance with Pennsylvania's building energy law does not ensure an energy efficient building by today's standards. A building that meets these standards is simply the *"worst"* building allowed by law.

The recommendations in this document have been compiled by TRF staff and represent good energy standards and practices. They are, however, very general in nature and will not apply to every building. Each building should be considered individually and the optimum combination of energy efficiency measures should be determined on a case-by-case basis.

The best way to optimize a building's efficiency and determine the appropriate level of energy efficiency measures is to use a building simulation computer model. The most widely recognized simulation program is DOE 2 (now available as PowerDOE), but there are other good computer models available to help with a large number of design issues. Such an analysis should be performed early in the design phase and used throughout as a decision-making tool.

Building Shell

Building Form - A building's shape and size will greatly affect its heating and cooling loads. Buildings of a compact form generally require less energy for heating and cooling than buildings which ramble and sprawl all over the site.

Building Orientation - Proper choice of architectural form and orientation can often reduce energy costs by a third or more at no extra cost. ☼ Building orientation on the site should respect the path of the sun. The long axis of the building should be oriented east/west to minimize solar gain in the summer and maximize solar gain in the winter. Windows on the north and west sides of the building should be minimized.

Air Infiltration - Reducing air infiltration is equal in importance to adequate insulation levels in reducing building heat loss. Thermal by-passes account for the majority of heat loss due to infiltration. Many areas of high air infiltration are not located in the exterior walls but in the interior of the building. These are typically hidden areas such as interior wall cavities, chases for plumbing, electrical and HVAC, and drop ceilings. These areas should be sealed or thermally isolated during construction.

Insulation - Determining the optimum level of insulation in commercial buildings is a complex process. One key factor is whether the building's loads are dominated by skin loads (typically one story, smaller buildings where the interior climate of the building is primarily influenced by the flow of heat through the building envelop or skin) or by internal loads (usually large, multi-story structures where the loads are primarily influenced by internal sources of heat gain such as people, lighting and office equipment). Skin load dominated buildings require more insulation than internal load dominated buildings. ☼ The <u>minimum</u> level of insulation in commercial buildings is contained in ASHRAE 90.1. Many energy efficient buildings exceed these levels by a factor of 2 to 3. ☼ Because they are ineffective at stopping air flow, drop ceilings should not be treated as a component of a building's thermal envelop. Do not place insulation on top of a drop, grid-type ceiling. ☼ Another practice to be avoided is the placement of fiberglass batts between roof rafters with a drop ceiling below. This results in no air barrier to vertical air movement. Use a flat roof or install an air barrier below the rafters. ☼ Use blown insulation instead of fiberglass batts where possible. Fiberglass batts, unless perfectly installed, do not provide optimal thermal performance. The performance of blown insulation is also superior at reducing air infiltration and thermal by-passes. ☼ All curbing for HVAC equipment, ventilation equipment and skylights should be insulated.

Windows - Windows should have low-e glass and an overall U value of 0.40 or less. The U values should be for the entire window, including the frame, and not a center-of-glass value. The U value should be certified by the National Fenestration Rating Council (NFRC) using the NFRC 100-91^{SM} procedure for determining the thermal performance of windows. ☼ Specify a low shading coefficient on west facing and possibly south facing windows. ☼ The type of window selected will have an energy impact. Fixed windows have the best energy performance when the interior spaces are conditioned year-round. However, most people prefer windows which open, and with proper design, operable windows can provide comfortable temperatures in the spring and fall without air conditioning or heating. Of the operable window types, casements will perform better than double hung or slider types. ☼ Minimum air infiltration standards are contained in ASHRAE 90.1.

Doors - Install insulated doors where possible with a minimum U value of 0.2 or less. ☼ Minimum air infiltration standards are contained in ASHRAE 90.1.

Electrical Systems

Lighting

Design - The first step in an efficient lighting design is to select correct illumination levels for the tasks being performed. Most lighting systems are designed with higher light levels than necessary, resulting in higher first cost and operating expenses. ☼ Once the proper illumination levels are determined for each space, the most efficient light source should be used (see the technologies section below). The lighting design should result in a lighting power density of about 1 watt per square foot in a typical building. ☼ Consider a lighting design that uses natural daylight to supplement the artificial lighting. ☼ Use a point-by-point design program instead of the lumen method. This will often result in fewer fixtures while still maintaining proper illumination. ☼ Even the most efficient light source will waste energy if it is left on when not in use. Controls should also be incorporated into the lighting design from the beginning. ☼ Light quality is an important consideration. Several recent studies have shown that improving light quality improves employee productivity and reduces absenteeism. Use lamps with a CRI or Color Rendering Index of 84 or more where appropriate. ☼ Consider using a task/ ambient lighting system. A modest ambient lighting level is maintained throughout the space and task lights are used to provide higher illumination levels at the work surfaces. ☼ In any lighting design, it is important to use light colored surfaces on modular furniture, wall coverings, ceiling, etc. to minimize artificial lighting. ☼ The lighting design should comply with ASHRAE 90.1 and IES standards.

Technologies - Use a lighting specification that ensures the installation of quality, energy efficient lighting components. ☼ An energy efficient lighting system should utilize the following light sources: T8 or T5 fluorescent tubes with electronic ballasts; compact fluorescent lamps with electronic ballasts instead of incandescent bulbs; tungsten halogen flood lamps instead of incandescent floods; high pressure sodium or metal halide lamps instead of mercury vapor; and LED exit signs instead of incandescent or fluorescent. ☼ All four-foot fluorescent fixtures should use 32 watt T8 tubes with a CRI of 84 or more. Electronic ballasts in fluorescent fixtures should be specified in detail to ensure quality materials. Avoid the use of 2x2 fluorescent fixtures because their tubes are expensive. Use four foot single-tube fluorescent fixtures where applicable even though they cost the same as four foot two-tube fixtures. ☼ Utilize compact fluorescent fixtures for recessed cans, wall sconces, table lamps, pendants, and other wall/ceiling fixtures. Specify high power factor ballasts in all compact fluorescent fixtures.
☼ In situations where compact fluorescent fixtures will not perform the necessary function, use halogen lamps in standard incandescent fixtures. ☼ High pressure sodium fixtures should be used in parking lots and on the exterior of buildings for security lighting. Metal halide fixtures can be used indoors in high ceiling areas and outdoors where color rendering is important. ☼ LED exit signs use just a few watts and last for 25 years or more and are more cost effective that compact fluorescent exit signs.

Controls - Make certain light switches are convenient and easily accessible. Divide the lighting in large rooms into several zones. ☼ Install motion sensor controls where the lights are likely to be left on in unoccupied spaces. Applicable areas include bathrooms, offices, conference rooms, kitchens, etc.
☼ Use spring-wound or switch timers in areas that are used infrequently such as mechanical rooms, unoccupied basements, and bathrooms.

Equipment

Office Machines - Purchase computers, printers and copiers with the EPA's ENERGY STAR designation. ENERGY STAR equipment incorporates a "sleep" function which powers down the machine during periods of inactivity. ☼ Use lap-top computers instead of desk-top microcomputers. Lap-tops use only 10% to 20% of the energy used by desk-top models. ☼ Purchase ink jet printers instead of laser printers. Ink jet printers use up to 95% less energy. ☼ Use plain paper ink jet fax machines instead of thermal paper or laser fax machines. ☼ Purchase solar desk top calculators.

Appliances - Specify ENERGY STAR for all appliance purchases. Window air conditioners, refrigerators, freezers, clothes washers, and dishwashers are all rated as to their efficiency and the best are listed in a catalog published by ACEEE (see Resources). ☼ Top freezer refrigerators are more efficient than side-by-side models. ☼ Chest freezers are more efficient than upright models. ☼ Horizontal axis, front load clothes washers are more efficient than top load washers. ☼ In most cases, if clothes dryers, cooking equipment, and dishwasher booster heaters are to be used during peak electrical demand periods, gas-fired equipment should be selected. Actual energy use is not much different, however, demand charges make gas-fired equipment far less costly to operate. ☼ Central station coffee makers with vacuum carafes should be used instead of individual coffee makers.

Mechanical Systems

Equipment Sizing - Oversized equipment costs more to purchase and to operate. The assumptions used in the sizing calculations need to be closely examined. HVAC designers add a safety factor to the calculated size to cover unknown contingencies. Oversizing HVAC equipment by a factor of two or three is common.

Life Cycle Costing - When selecting the HVAC system, the initial cost is usually the determining factor. This cost is only one of many which should be considered. Life cycle costing takes into account all costs associated with the purchase, maintenance and operation of an HVAC system over its useful life. The system with the lowest life cycle cost should then be selected. A life cycle costing analysis can be used to evaluate a wide variety of HVAC systems. System efficiency, energy costs, fuel selection and maintenance expenses can all be evaluated using life cycle costing.

Fuel Selection - For most conventional HVAC applications, electric equipment is more expensive to operate than natural gas or fuel oil. ☼ Commonly installed electric resistance wall mount, baseboard or unit heaters in stairwells, vestibules, utility rooms, and hallways should be replaced with central distribution or eliminated entirely. Even if this equipment is on only rarely, the contribution to demand charges will usually justify its elimination.

Conventional HVAC Equipment - **Boilers**: When installing a boiler system, consider the use of multiple, modular boilers to better match the varying loads. ☼ **Packaged Roof-Top Units**: Specify high efficiency equipment (EER 10 or more) and units with an economizer cycle for free cooling. ☼ **Split System Air Conditioners/ Heat Pumps**: Specify units with a high efficiency. Units below 5.4 tons, specify a minimum SEER of 12. Units over 5.4 tons, specify a minimum EER of 10. ☼ **Furnaces**: Specify units with a high efficiency (natural gas - AFUE 90% or more; fuel oil - AFUE 85% or more). ☼ **Water Source Heat Pumps**: Specify units with an EER 12 or more. Check the website of the Consortium for Energy Efficiency - http://www.cee1.org/ - for a listing of efficient products.

Unconventional HVAC Equipment - Gas cooling, absorption cooling, cogeneration, electric thermal storage for heating and cooling, ground source heat pumps, infrared heating and other nontraditional technologies can be cost effective in the proper application. These systems require careful study to determine their viability in your situation. Some of these systems should be included in a life cycle costing analysis for the HVAC system.

Distribution Systems - Insulate all steam and hot water pipes in unconditioned spaces. ☼ All ducts should be gasketed between sections or sealed with mastic (do not use duct tape). Avoid fiberboard ducts and flex duct. If flex duct is used, it should be used only in runs under 10 feet.

Controls - All HVAC equipment should be capable of scheduled unoccupied temperature control. This control can be as simple as a timer which turns off the boiler or a programmable thermostat. ☼ The next level of control would include demand limiting capabilities. Small scale controllers that limit demand can be cost effective in small to medium commercial buildings. ☼ Larger facilities should consider the installation of an energy management system to add more sophisticated control. ☼ A key factor in the selection of a control system is the simplicity of the system. If the building's operators cannot totally understand and operate the system, it will not serve its purpose. ☼ Zoning can be an effective means of control if properly applied. Sections of the building which have different operating schedules, uses, temperature requirements and orientation are good candidates for zoning. Zoning also allows for some variability in temperature control in a given area to satisfy the comfort requirements of the building's occupants.

Ventilation Equipment - This equipment should include controls to close the system when the building is unoccupied. This could include timers on exhaust fans, motorized dampers on outside air intakes and sensors to turn off equipment operating unnecessarily. ☼ Specify low leakage dampers on all applicable systems. ☼ In some cases where large amounts of ventilation are required, heat recovery ventilators can be used to pull the heat out of the outgoing air stream.

Plumbing Systems

Service Hot Water - Select tank-type water heaters with a high energy factor (EF). Such tanks will include high levels of insulation. Gas-fired water heaters should have an EF of 0.62 or more; electric heaters should have an EF of 0.93 or more; and oil-fired heaters should have an EF of 0.60 or more. ☼ Avoid electric water heaters unless they are placed on a timer to avoid peak demand periods. ☼ Avoid tankless coils in the boiler unless the boiler must operate year-round for other thermal loads. ☼ Small instantaneous type water heaters can be a good energy saver to heat water in a location remote from the main water heater.

Water Consuming Devices - Specify showerheads with a flow rate no greater than 2.5 gallons per minute (GPM). ☼ Specify bathroom faucets with a flow rate of 1.0 GPM or less. ☼ Specify toilets using 1.6 gallons or less per flush (GPF) or less. ☼ Specify urinals using 1.0 gallons or less per flush. ☼ Install the properly sized water meter for the projected water consumption. With some water utilities, the size of the meter determines the monthly service charge.

Operations and Maintenance

Proper maintenance is essential to conserving energy in the long term. The building should be designed with future maintenance in mind. Easy access to equipment should be designed into the building from the beginning. The major components of the mechanical and electrical systems should be labeled. As-built drawings should be provided, especially for the mechanical and electrical systems. A manual containing operating instructions and information on all of the components of the mechanical and electrical systems should be provided.

Green Buildings

Green buildings represent a departure from conventional practice in how we design, construct and operate buildings. Good sustainable building design includes high levels of energy efficiency, but goes further to lessen environmental impacts, reduce resource consumption and improve occupant health and productivity. Issues concerning indoor air quality, the recycled content and ultimate recyclability of building materials, construction waste reduction, the use of local building materials, and the impacts of design and building materials on the occupants are considered in the decision-making process. The Leadership in Energy and Environmental Design (or LEED) process has become the default methodology for certifying green buildings. LEED is managed by the U.S. Green Building Council and its website - http://www.usgbc.org/ - has much useful information.

Resources

ENERGY STAR. http://www.energystar.gov/

Consortium for Energy Efficiency. http://www.cee1.org/

U.S. Green Building Council (Leadership in Energy and Environmental Design). http://www.usgbc.org/

U.S. Environment Protection Agency's High Performance Schools website. http://www.epa.gov/iaq/schooldesign/highperformance.html

U.S. Department of Energy's High Performance Buildings website. http://www.eere.energy.gov/buildings/highperformance/

Pennsylvania Governor's Green Government Council, Guidelines for Creating High Performance Green Buildings, http://www.gggc.state.pa.us/gggc/cwp/view.asp?a=515&q=156978

Delaware Valley Green Building Council. http://www.dvgbc.org/

Energy Efficient Buildings: Institutional Barriers and Opportunities. E Source, Inc., 1050 Walnut Street, Boulder, CO 80302-5140, 303-440-8500. Covers the reasons why buildings are not as energy efficient as they should be and offers suggestions on reinventing the design process.

ASHRAE Standard 90.1-1989, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating, and air Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329-2305, 404-636-8400. Used as the basis for most energy codes for commercial buildings.

NFRC Certified Products Directory. National Fenestration Rating Council, 1300 Spring Street, Suite 120, Silver Spring, MD 20910, 301-589-6372. Standardized energy efficiency rating of windows.

The Most Energy-Efficient Appliances. American Council for an Energy-Efficient Economy, 2140 Shattuck Avenue, Suite 202, Berkeley, CA 94704, 510-549-9914. A current listing of the highest efficiency appliances on the market.

Directory of Certified Equipment. Air-Conditioning & Refrigeration Institute, 4301 North Fairfax Drive, Suite 425, Arlington, VA 22203. Listing of efficiencies for all cooling equipment.

A Primer on Sustainable Building. Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, CO 81654-4178, 303-927-3851. An introduction to the process of producing green buildings.

The Energy Design Handbook. The American Institute of Architects, 1735 New York Avenue NW, Washington, DC 20006, 800-365-2724. Guide to the design and construction of energy efficient buildings.

For More Information

For more information about the issues addressed in this document, please contact Roger E. Clark at the Reinvestment Fund at roger.clark@trfund.com or 215.574.5814.

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TRF Energy's Checklist for Energy Efficient Construction

Building Design

- ☐ Commit to incorporating energy efficiency into the building early in the design phase. Make energy efficiency a shared concern for all members of the design team.
- ☐ Evaluate design and equipment alternatives on a life-cycle cost basis.
- ☐ Perform a computer simulation to determine the optimum combination of energy efficiency measures.

Building Shell

Building Form and Orientation

- ☐ Determine the optimum building size and configuration.
- ☐ Choose the proper building orientation. Use less glazing on the west and east facades and more on the south facade.

Insulation

- ☐ Seal all thermal by-passes.
- ☐ Insulate to 2 to 3 times the levels recommended in ASHRAE/IES Standard 90.1-1989.
- ☐ Use blown insulation instead of batts where possible.
- ☐ Do not insulate directly on top of drop ceilings. Do not install fiberglass batts between roof rafters of a peak roof without an air barrier.
- ☐ Insulate all curbing in roof penetrations where part of the thermal envelop.

Windows

- ☐ Install low-e glass windows with an overall U-value of 0.4 or less and that meet the minimum air infiltration standards contained in ASHRAE 90.1, as certified by the National Fenestration Ratings Council.
- ☐ Specify a low-shading coefficient on west facing windows.
- ☐ The best energy performers are fixed windows. Casement windows outperform single or double hung or slider type windows.

Exterior Doors

- ☐ Install insulated doors with a minimum U value of 0.2 or less and that meet the minimum air infiltration standards contained in ASHRAE 90.1.
- ☐ Provide double-doored vestibules for heavily used entrances.

Roof

- ☐ Use an ENERGY STAR reflective roof.
- ☐ Ventilate the roof.

Lighting

Design

- ☐ Design to the proper light level. Do not over-light spaces. Use a good lighting specification for energy efficient components and design. Use point-by-point design programs instead of the lumen method.
- ☐ Aim for a lighting power density of 1 watt per square foot.
- ☐ Consider a task/ambient lighting system.
- ☐ Specify efficient light sources appropriate for the task.
- ☐ Comply with the lighting provisions of 90.1 as a minimum.

Lighting Fixtures and Hardware

- ☐ Install high quality lamps with high color rendering. Use T8 or T-5 fluorescent tubes (84+ CRI).
- ☐ Specify electronic ballasts in fluorescent fixtures.
- ☐ Avoid the use of 2x2 fluorescent fixtures.
- ☐ Use single tube fluorescent fixtures where applicable.
- ☐ Install compact fluorescent fixtures instead of incandescent. Use tungsten halogen instead of incandescent lamps where compact fluorescents are ineffective.
- ☐ Specify high power factor ballasts for compact fluorescent fixtures.
- ☐ Do not use mercury vapor lamps. Instead, use high pressure sodium or metal halide lamps.
- ☐ Use high pressure sodium lamps for exterior security lighting.
- ☐ Use metal halide in high ceiling areas and outside where color rendering is important.
- ☐ Use LED exit signs.

Lighting Control

- ☐ Incorporate lighting controls into the design.
- ☐ Install lighting switches in convenient and accessible locations.
- ☐ Divide large rooms into several lighting zones.
- ☐ Install motion sensor controls where applicable.
- ☐ Install switch timers in infrequently used spaces.

Electrical Equipment

Office Equipment

- ☐ Purchase Energy Star computers, printers and copiers. Purchase laptop computers. Use ink jet printers instead of laser printers. Purchase ink jet fax machines.
- ☐ Purchase a central station coffee system using vacuum carafes. Purchase solar desk top calculators.

Appliances

- ☐ Purchase ENERGY STAR refrigerators, freezers, clothes washers, dishwashers, etc.
- ☐ Specify top freezer refrigerators instead of side-by-side models.

- ☐ Specify chest type freezers instead of upright models.
- ☐ Specify horizontal axis clothes washing machines.
- ☐ Use gas-fired clothes dryers, cooking equipment and dishwasher booster heaters.

Heating, Ventilation and Air Conditioning (HVAC)

Design

- ☐ Properly size HVAC equipment. Avoid exaggerated over-sizing.
- ☐ Perform a life cycle costing on several HVAC options to determine the best system over the long term.
- ☐ Consider modular boilers.
- ☐ Consider dual-fuel boilers.

Heating Equipment

- ☐ Avoid electric resistance heat in any form.
- ☐ Specify high efficiency units for packaged units, split systems, heat pumps, and furnaces.
- ☐ Packaged units should have an EER of 10 or more and an economizer cycle.
- ☐ Split systems/heat pumps under 5.4 tons should have an SEER of 12 or more. Split systems/heat pumps over 5.4 tons should have an SEER of 10 or more.
- ☐ Gas-fired furnaces should have an AFUE of 90% or more. Oil-fired furnaces should have an AFUE of 85% or more.
- ☐ Water source heat pumps should have an EER of 12 or more.
- ☐ Consider unconventional HVAC equipment if life cycle cost is low.

Distribution Systems

- ☐ Insulate all hot water and steam pipes.
- ☐ All ducts should be gasketed or sealed with mastic.
- ☐ Avoid fiberboard ducts and flex duct. If used, flex duct runs should not exceed 10 feet.
- ☐ Specify low leakage dampers.
- ☐ Areas with high rates of ventilation could be candidates for heat recovery equipment.

HVAC Controls

- ☐ Use programmable thermostats or timers to regulate unoccupied temperature.
- ☐ Consider demand-limiting controls.
- ☐ Consider an energy management system.
- ☐ Zoning can be an effective control strategy in many buildings.
- ☐ Ventilation equipment should be off or closed when the building is unoccupied.

Plumbing

Water Heating Equipment

- ☐ Select water heaters with an high energy factor. Gas water heaters should have an EF of 0.62 or greater. Electric water heaters should have an EF of 0.93 or greater. Oil water heaters should have an EF of 0.60 or greater.
- ☐ Avoid electric water heaters.
- ☐ Consider two water heating systems, one set at 140ºF for the kitchen and the second set at 110ºF for the rest rooms.
- ☐ Use instantaneous water heaters in place of long pipe runs.
- ☐ Avoid tankless coils in boilers without other summer loads.
- ☐ Consider gas-fired saunas and steam rooms instead of electric.

Water-Using Fixtures

- ☐ Specify showerheads with a flow rate of 2.5 GPM or less.
- ☐ Specify bathroom faucets with a flow rate of 1.0 GPM or less.
- ☐ Specify toilets with a flush of 1.6 gallons or less.
- ☐ Specify urinals with a flush of 1.0 gallons or less.
- ☐ Install the proper size water meter.

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