Water Efficiency in the Commercial and Institutional Sector: Considerations for a WaterSense Program

August 20, 2009

Statement of Purpose

The U.S. Environmental Protection Agency (EPA) established WaterSense® with the goal of saving water for future generations. By transforming the market for water-efficient products, services, and practices, WaterSense is helping to relieve the strain of expanding water supply and wastewater infrastructure. Since 2006, the WaterSense label has helped consumers identify products and services that meet EPA's criteria for water efficiency and performance.

In an effort to further this mission, EPA is now considering expansion of WaterSense to include partnership and participation options for users in the commercial and institutional (CI) sector. With this in mind, EPA is seeking input from its partners and other stakeholders on the current state of data related to water use in the CI sector as well as potential program options.

The following white paper summarizes the current state of knowledge regarding water use in the CI sector. While there are gaps in the currently available data, this paper attempts to summarize the best available resources that EPA can use as a basis for future decision-making regarding a national CI program. The paper also includes a discussion of the various forms that a CI focused component of WaterSense could take.

EPA is seeking broad input to be used as guidance in developing the WaterSense CI sector program. In particular, EPA is interested in hearing the responses of stakeholders in the following areas and questions:

Data Gaps and Research Needs

- What research needs to be done or data collected on the CI sector? What information gaps exist?
- Are you aware of any reliable data that is not cited in this paper and could add substantially to our understanding of water use in the CI sector?
- If EPA were to set a water use percent reduction target for the CI sector as a whole or for specific subsectors, what should EPA use as the water use baseline and what percent reduction should be targeted?
- What impact could a national sector water-efficiency program have on the revenue and rate structure of drinking water utilities?
- What issues and barriers stand in the way of a national CI sector water-efficiency program? How can EPA overcome them?

Program Design Options

- Should EPA address all subsectors together or separately?
- Are the factors for choosing a subsector appropriate?
- What are the pros and cons of each program structure presented?

- What program structure do you think EPA should adopt and why?
- Is it important to have WaterSense labeled CI sector facilities?
- If a certification and labeling scheme is preferred, should EPA have a single-tiered or multi-tiered program? Should certification be third-party or self declaration? Should a specification include percentage reduction requirements, best management practices (BMP) implementation requirements, or both?
- If EPA chose a partnership-commitment program structure, what should the commitment be? What reporting should be required?
- If EPA offered technical assistance, what should it be and in what form should it be offered?
- If a subsector-specific approach is chosen, should EPA's efforts focus on the largest overall users of water, or on the largest individual accounts?
- If a subsector-specific approach is chosen, what factors should be considered in prioritizing different subsectors?
- Should EPA offer an awards program?
- What other incentives should EPA offer for participating in the program?

EPA is welcoming comments on the above questions and the following white paper. Comments may be submitted to watersense-ci@erg.com through September 20, 2009.

WaterSense will also be holding a meeting to discuss potential CI program options in conjunction with the WaterSmart Innovations conference in Las Vegas, Nevada. If you are interested in attending this meeting please contact the WaterSense Helpline at (866) WTR-SENS (987-7367) or watersense@epa.gov.

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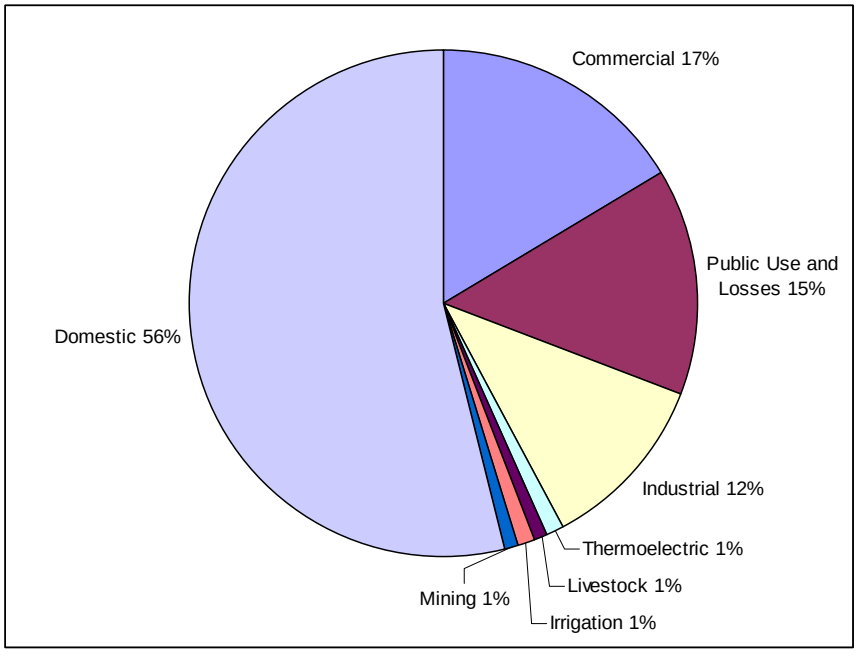
I. Background and Purpose

To help American consumers and businesses use water more efficiently, in 2006, U.S. Environmental Protection Agency (EPA) launched WaterSense, a voluntary partnership program that aims to protect the future of our nation's water supply. While to date WaterSense has focused on the residential sector, EPA is considering adding a program to promote water efficiency in the commercial and institutional (CI) sector as well. As a first step, EPA has written this white paper to summarize information gathered to date on the CI sector and to discuss all potential facets of the program. The purpose of this paper is to solicit input from partners, stakeholders, and the general public that WaterSense can use as a foundation for developing a CI sector program.

The CI sector consumes a significant portion of the publicly supplied fresh water in the United States. The U.S. Geological Survey (USGS) collects data on publicly supplied water as part of its periodic survey of estimated water uses in the United States, and, until 1995, had broken out data on CI uses from publicly supplied water. In those earlier surveys, it defined the CI sector to include hotels, motels, restaurants, office buildings, other commercial facilities, and civilian and military institutions. Public water supplied to golf courses was also included, as were fish hatcheries in some states. In the last water use report containing CI data (compiled in 1995), USGS estimated that the sector utilized 17 percent of water drawn from public water supplies in the United States, as shown in Figure 1. (1)

Figure 1. Estimated Distribution of Water Use From Public Supplies in the United States in 1995



Source: Modified from *USGS Estimated Use of Water in the United States in 1995*

A 2000 report, *Commercial and Institutional End Uses of Water,* estimates that combined water use of all CI customers constitutes approximately 15 to 25 percent of total municipal water demand. That report also describes an American Water Works Association (AWWA) survey of 331 large water agencies, which estimates that nonresidential users account for 44 percent of total metered urban water use. Elsewhere, the report includes information on an independent survey of 28 agencies in Southern California that estimate commercial and public uses account for 18.8 percent and 5.1 percent of metered urban water use, respectively (3). Despite some variability, all studies indicate that the CI sector is a substantial consumer of water in the United States.

One reason why it's difficult to accurately determine how much publicly supplied water the CI sector consumes is because the definition of the sector varies among water utilities and in water use literature. In most cases, the CI sector is defined as any business establishment or institution other than a manufacturing or industrial plant. See Section II for more on the definition and scope of the CI sector.

Regardless of the definition used for CI sector, it's becoming clear that increased efficiency in this sector will be vital as water resources grow scarcer. EPA considers the data presented in this paper to be the best available regarding water use and efficiency in the CI sector.

II. Overview of the Commercial and Institutional Sector

The CI sector consists of a large number of subsectors that vary greatly in how they function and in how they use water. While some water utilities have water efficiency and conservation initiatives targeting the CI sector, as a whole it has received less attention than the residential sector, largely due to a lack of data on water use within CI subsectors. This section presents CI sector definitions, classifies CI subsectors, highlights key end uses of water in CI subsectors, and discusses water-efficient practices and technologies.

II.A Defining the CI Sector

Literature on urban water efficiency shows several definitions of the "nonresidential" sector. The sector containing the industrial, commercial, and institutional users of urban water is designated as the ICI or CII sector. Where significant industrial customers are not present, the term CI is often used. As mentioned earlier, the definitions of the CI sector vary between water utilities and from study to study. For example, some agencies define the CI sector as all business accounts in the commercial sector, which may include manufacturing and governmental facilities, while others may separate industrial and institutional sectors. In addition, residential complexes such as apartment buildings or mobile home parks, for which accounts may be registered in the name of a business entity, are often considered commercial accounts (3).

The California Urban Water Conservation Council (CUWCC) adopts the following definition of commercial water users (7):

> Commercial customers include customers that provide or distribute a product or service, such as hotels, restaurants, office buildings, or commercial business, and other places of commerce. Also included are establishments dedicated to public service, including

schools, courts, churches, hospitals, and government facilities. All facilities serving these functions are included regardless of ownership.

The Pacific Institute report *Waste Not, Want Not* defines the CII sector as follows (4):

- Commercial: Private facilities providing or distributing a product or service, such as hotels, restaurants, or office buildings. This description excludes multi-family residences and agricultural uses.

- Institutional: Public facilities dedicated to public service including schools, courthouses, government buildings, and hospitals.

- Industrial: Facilities that mostly manufacture or process materials as defined by the Standard Industrial Classification (SIC) code numbers 2000 through 3999.[1]

Studies of CI water use often group CI users of water together for analytical purposes, since the distinction between what is considered commercial (e.g., a private school) and what is considered institutional (e.g., a public school) is somewhat arbitrary (4).

For the purposes of this paper, EPA is defining CI users as any use other than residential accounts and those that can be clearly classified as industrial accounts.

II.B CI Subsectors

Within the CI sector, water use varies by customers (or "customer types"), which can be grouped into subsectors. See Section II.C for a discussion of the various end uses of water by subsectors. Using EPA's definition in Section II.A, subsectors that fit into the CI sector include:

- Office Buildings
- Schools/Educational Complexes
- Restaurants and Fast Food Outlets
- Commercial and Retail Centers
- Hotels and Motels
- Grocers/Food Stores
- Hospitals
- Laboratories
- Laundries
- Vehicle Washes
- Bakery/Pastry Shops
- Auto Service and Repair Shops
- Fuel Service Stations and Convenience Stores
- Golf Courses
- Churches/Sanctuaries

[1] Note that the North American Industrial Classification System (NAICS) replaced the SIC system in 1997, and the new NAICS codes do not correspond to the old SIC codes. The water industry has not integrated the new classification system into general practice yet (3).

- Correctional Facilities
- Meeting and Recreation Facilities
- Utilities and Infrastructure
- Other

CI water use varies from region to region, due to climate and economic factors that affect the amount of seasonal water use (e.g., landscape water use and cooling needs in warmer months). CI water use can even vary among water utilities in the same region, depending on the major CI customers and the end uses of water in each service area.

While distribution of water use among these CI subsectors has been studied, there remains some uncertainty since their classification is not uniform across utilities, and this data is not collected and maintained regularly. For example, some utilities classify hotels/motels and restaurants as two separate CI subsectors, while others categorize them together as "hospitality." Though some studies have classified CI water use by subsector for specific states, cities, or water utilities, this type of analysis has not been done at the national level. See Appendix A for a summary of the research available.

To evaluate water usage by subsector and to identify which ones typically demonstrate the highest levels of consumption, EPA analyzed data available from three primary sources on the percent of water use by subsector. (1, 4, 7) Table 1 displays data compiled from all three sources for subsectors where substantial parity exists between subsector definitions. Despite some variation, all available studies indicate that office buildings, schools, hospitality, and healthcare facilities are likely to be the largest water uses when looking at a national breakout.

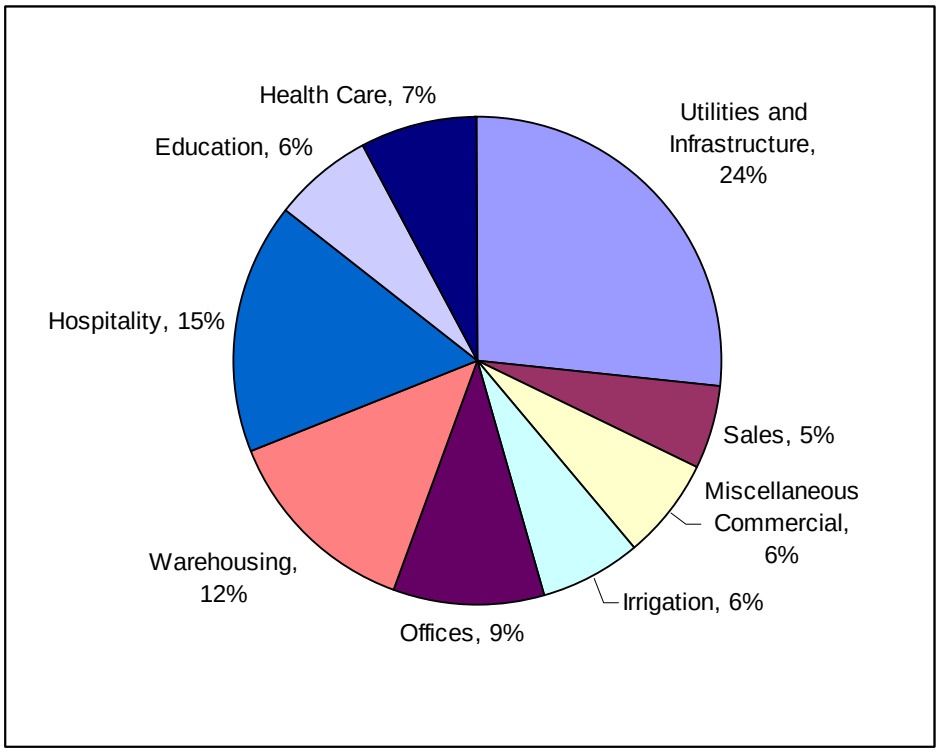
Table 1. Estimated Percent Commercial Water Use in the United States by Subsector

CI Subsector	Range Identified From All Three Primary Sources [a]	Range Reported in 1997 Survey [b]	Weighted Avg. [c]
Hospitals/Healthcare Facilities	2-20	7-12	7.32
Office Buildings	8-17	9-12	9.2
Schools	5-13	5-8	5.88
Hospitality	6-16	9-21	14.8
Laundries	1-4	1-4	1.73
Car Washes	0-2	0-1	0.28

[a] Source: Compiled and summarized from: Peter H. Gleick, et. al., *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003; Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000; U.S. EPA, *Study of Potential Water Efficiency Improvements in Commercial Businesses*, Grant CX 823643-01-0 with the State of California Department of Water Resources, April 1997.
[b] Source: Idem.
[c] Source: Dziegielewski, op. cit. (Originally derived from U.S. EPA, op. cit.)

EPA found that the *Study of Potential Water Efficiency Improvements in Commercial Businesses* completed in April 1997 provided the most complete data for comparing water use by subsectors nationwide. (7, 3) This study is based on commercial water use broken down by subsector at a dozen water utilities across the United States. The data presented in Figure 2 also indicates that hospitality (restaurants and overnight lodging), office buildings, healthcare facilities, and educational facilities are likely the largest water users in the CI sector.[2] These results represent the largest national data sample to date, and are consistent with other available studies regarding subsector water usage within the CI sector.

Figure 2. Estimated Distribution of CI Water Use in the United States in 1995 by Subsector



Source: Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000 (originally derived from U.S. EPA, *Study of Potential Water Efficiency Improvements in Commercial Businesses*, Grant CX 823643-01-0 with the State of California Department of Water Resources, April 1997.)

II.C End Uses of Water

Despite the differences between subsectors and the factors contributing to their water needs, many have similar end uses for water (see Table 2). For example, domestic water use for plumbing fixtures such as toilets, faucets, showerheads, and urinals represents from one-quarter to one-half of all water use within most of these facilities. (3) Many of these facilities also

[2] Although the percent of water use associated with them is high, EPA did not consider water use associated with the categories of "utilities and infrastructure" and "warehousing" because of the inconsistent definitions of these types of facilities from study to study and utility to utility.

utilize a significant portion of their water for irrigation and landscaping. Finally, at least half of the facilities use a significant amount of their water for heating and cooling purposes.

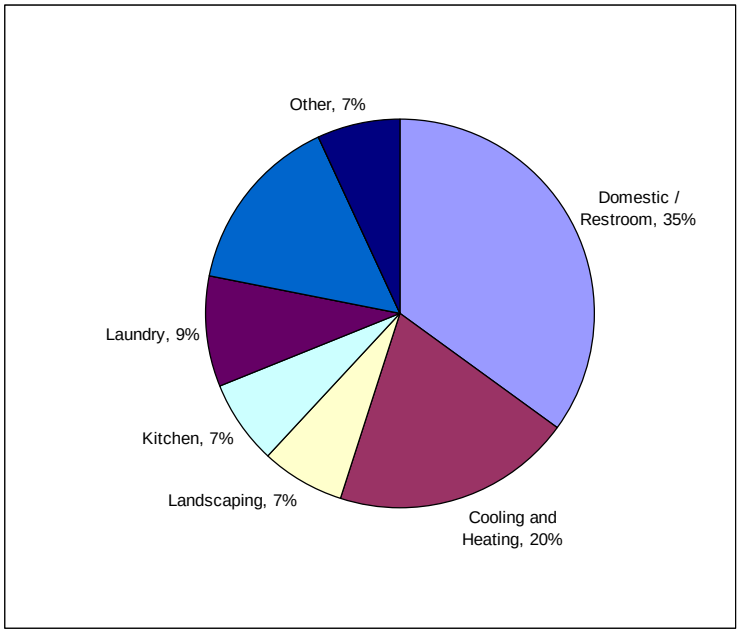
Table 2. Examples of Potential End Uses of Water in CI Facilities

Indoor/Domestic Water	
• Kitchens, Cafeterias, Staff Rooms o Faucets o Distilled/drinking water o Dishwashing machines o Ice machines o Garbage disposals o Food preparation o Frozen yogurt and ice cream machines • Restrooms and showers o Faucets o Toilets and urinals o Showers	• Laundry o Washing machines • Sanitation o Facility cleaning o Sterilizers/autoclaves o Equipment washing o Dust control o Container washing • Process o Photographic and x-ray processing
Cooling and Heating	**Outdoor Water Use**
• Cooling towers • Evaporative coolers • Boilers and steam systems • Once-through cooling o Air conditioners o Air compressors o Hydraulic equipment o Degreasers o Rectifiers o Vacuum pumps	• Irrigation • Pools and spas • Decorative water feature

The *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, developed by East Bay Municipal Utility District (EBMUD) in 2008, details end uses of water for 20 CI and industrial subsectors. The manual also provides information for users to determine the most efficient water practices and equipment for these specific subsector types. Water use in restaurants and fast food chains breaks down as kitchen (47 percent), domestic and restrooms (33 percent), other (13 percent), landscape (5 percent), and cooling and heating (2 percent). Kitchen uses include cooking and serving systems (combination ovens, pasta cookers, steamers), scullery operations (pre-rinse spray valves, dishwashing), ice machines, and more. This example shows how specific end uses of water can be identified within a specific subsector. For some subsectors, EBMUD could not determine the specific distribution in end water uses, but could identify what those uses were. Understanding end uses is crucial for determining water-efficiency and conservation opportunities. (5)

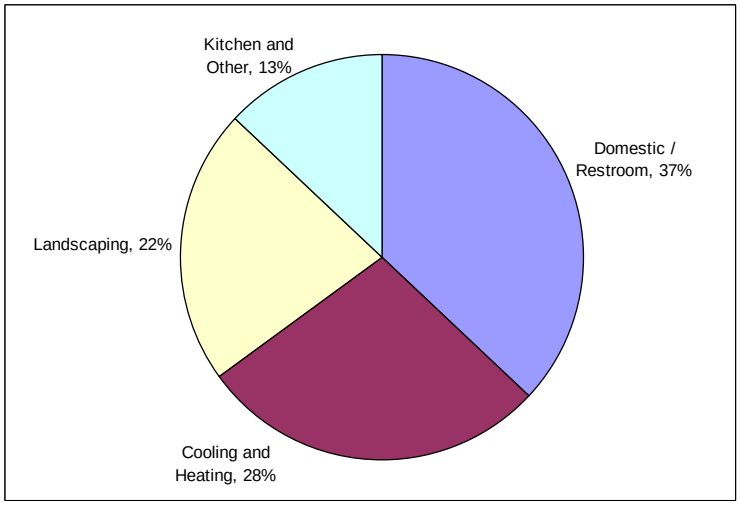
In an effort to better understand the nature of end uses in the CI sector, EPA has summarized the end use data for those subsectors where significant data is available and there is significant parity among various studies to reasonably compare results. The following figures are based on the average results from a number of sources as cited for each individual subsector below. See Appendix B for a more detailed discussion of these data sources.

Figure 3. End Uses of Water in Hospitals



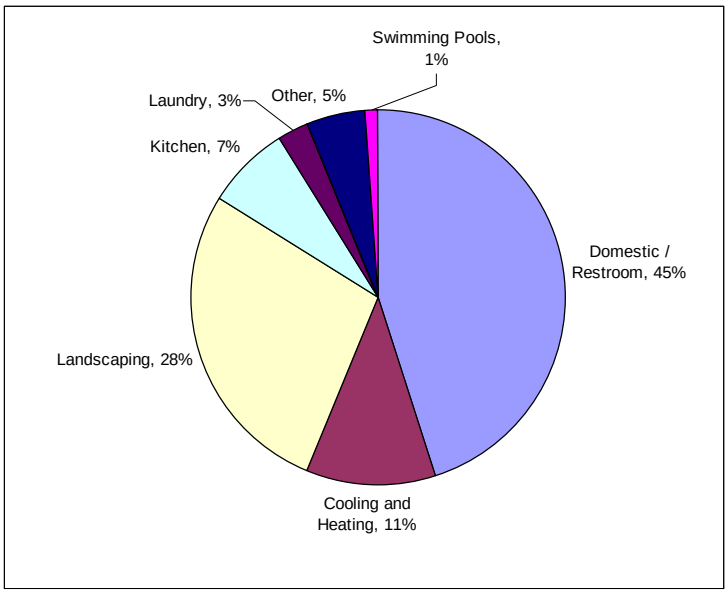
Source: Created from analyzing data in: New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department); Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000; East Bay Municipal Utility District, *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, 2008; American Water Works Association, *Helping Businesses Manage Water Use, A Guide for Water Utilities*.

Figure 4. End Uses of Water in Office Buildings



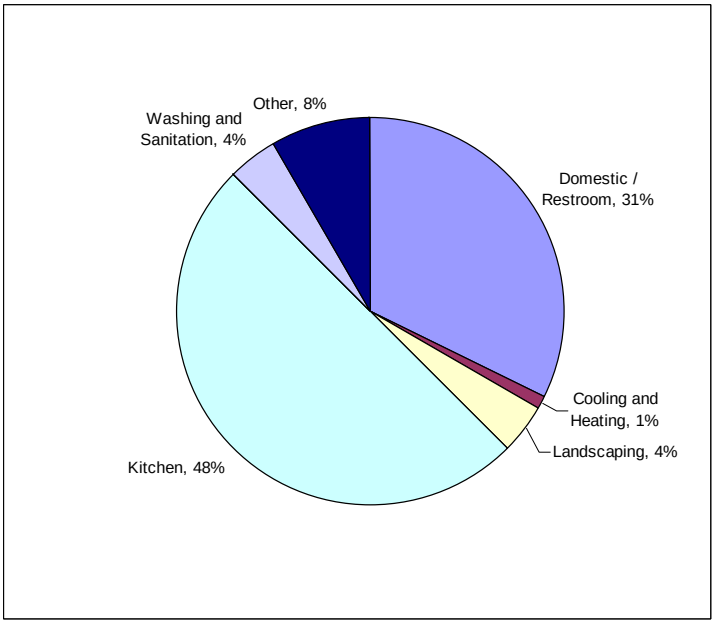
Source: Created from analyzing data in: New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department); Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000; East Bay Municipal Utility District, *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, 2008; American Water Works Association, *Helping Businesses Manage Water Use, A Guide for Water Utilities*.

Figure 5. End Uses of Water in Schools



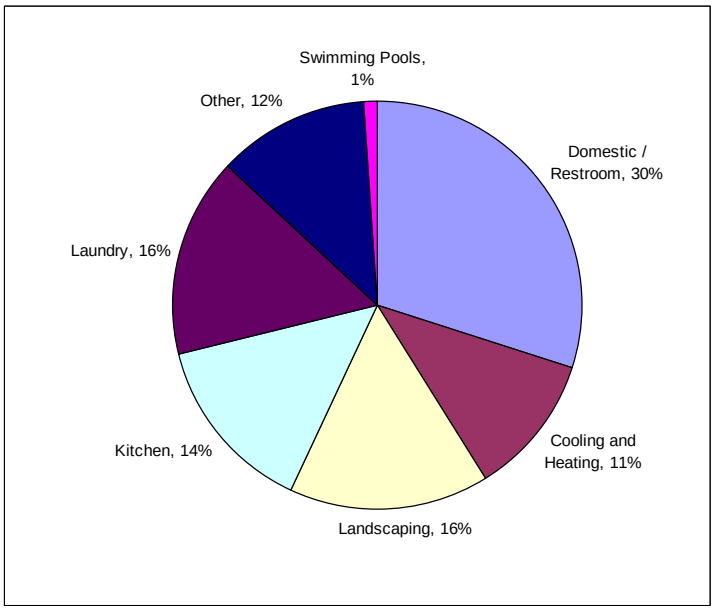
Source: Created from analyzing data in: New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department); Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000; East Bay Municipal Utility District, *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, 2008; American Water Works Association, *Helping Businesses Manage Water Use, A Guide for Water Utilities*.

Figure 6. End Uses of Water in Restaurants



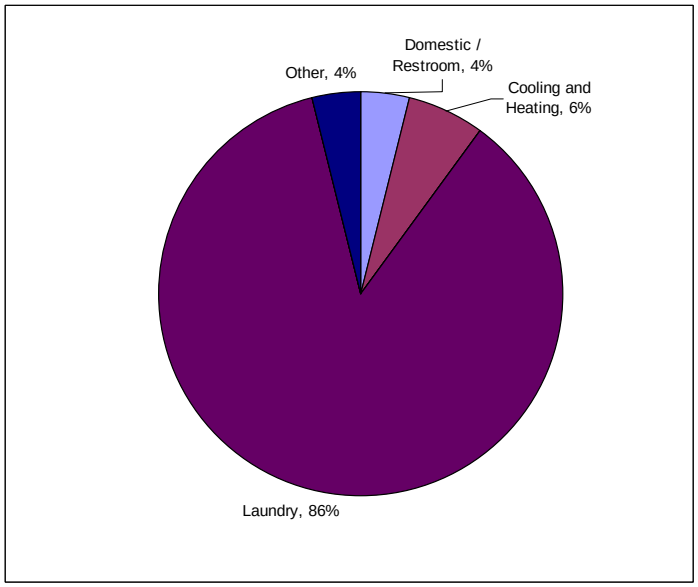
Source: Created from analyzing data in: Dziegielewski, et. al., Commercial and Institutional End Uses of Water, 2000; East Bay Municipal Utility District, WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses, 2008; American Water Works Association, Helping Businesses Manage Water Use, A Guide for Water Utilities.

Figure 7. End Uses of Water in Hotels and Motels



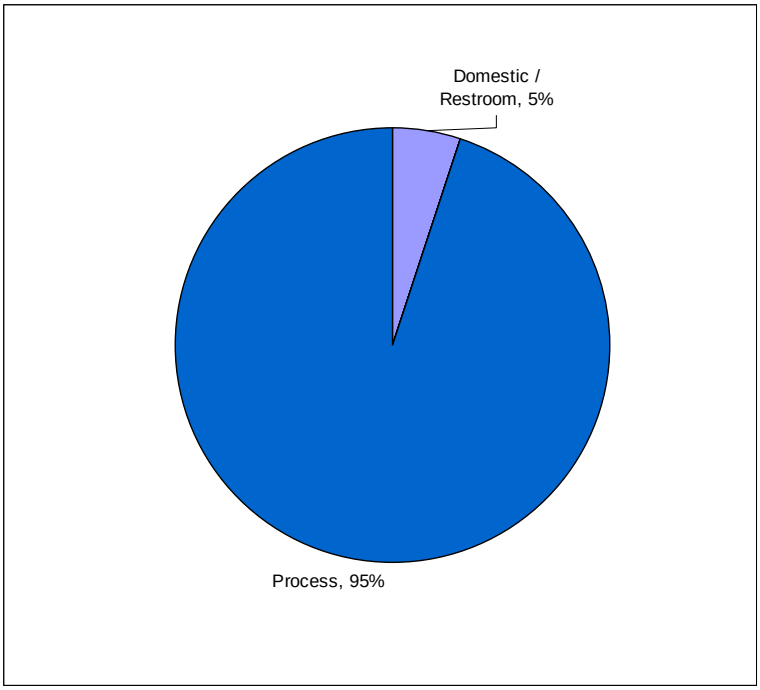
Source: Created from analyzing data in: New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department); Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000; East Bay Municipal Utility District, *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, 2008; American Water Works Association, *Helping Businesses Manage Water Use, A Guide for Water Utilities*.

Figure 8. End Uses of Water in Laundries



Source: Created from analyzing data in: Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000; East Bay Municipal Utility District, *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, 2008; American Water Works Association, *Helping Businesses Manage Water Use, A Guide for Water Utilities*.

Figure 9. End Uses of Water in Car Washes



Source: Modified from East Bay Municipal Utility District, *WaterSmart Guidebook: A Water Use Efficiency Plan Review Guide for New Businesses*, 2008.

II.D Potential Water Savings and Benchmarks

While some information is available regarding water use and end uses within CI facilities, data on potential water savings in the sector is scarce, especially on a national scale. The Pacific Institute's report *Waste Not, Want Not: The Potential for Urban Water Conservation in California* provides some of the only estimates of water savings available. The report used data surveys and sector-level water studies to estimate that water use in the CI sector could be reduced by approximately 40 percent from 2000 levels in the state or 317 billion gallons of water per year. (4) Although these estimates are specific to California, the substantial savings could be achieved in other areas of the country using similar technologies and practices. These significant savings highlight the enormous potential for a national-level program. Additional data is necessary to fully define the potential impact of a national water-efficiency program for the CI sector.

In addition to the overall 40 percent reduction, the potential savings can be broken down into several subsectors as follows:

Table 3. Potential Water Savings in CI Subsectors

CI Subsector	Total Potential Savings (Thousand Acre-Feet)	Total Potential Savings (Gallons)
Hospitals/Healthcare Facilities	15	4,887,771
Offices	133	43,338,240
Schools	116	37,798,766
Restaurants	48	15,640,869
Hospitality	10	3,258,514
Laundries	15	4,887,771
Total Commercial	**714**	**232,657,920**

Source: Modified from the best estimate of practical savings in the CII sector from Peter H. Gleick, et. al., *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003.

Although the potential savings have been defined in some areas of the country, benchmarks for facility water use are even more difficult to determine. The *Commercial and Institutional End Uses of Water* report attempts to develop efficiency benchmarks for facilities in each of the five subsectors studied–restaurants, hotels and motels, supermarkets, schools, and office buildings–breaking end use into the categories of indoor water use, cooling water use, and irrigation water use. While these efficiency benchmarks are based on a small amount of available data, they suggest water use in various units that could be achieved by efficient facilities. (3)

Additional data and information is needed to create viable benchmarks for CI facilities on a national scale. The development of such metrics is not only difficult due to a lack of data, but it is further complicated by differences in the structure and categorization of facilities that affect the normalization factors (e.g., gallons per square feet, gallons per employee per day) that could be used to compare water use between differently sized facilities. Because facilities contain different components, it is almost impossible to define a subsector-wide benchmark without more specific data than what is currently available. Further information would be necessary to develop these efficiency metrics for each particular subsector under a national CI program.

II.E Water-Efficient Practices and Technologies

Despite the variety of end uses in CI subsector establishments, water savings opportunities have been identified that are applicable across the CI sector and specific subsectors. There is a significant amount of literature detailing water-efficiency and conservation projects applicable to CI facilities, including the documents: *A Water Conservation Guide for Commercial, Institutional and Industrial Users* (6), EBMUD's *WaterSmart Guidebook: A Water-Use Efficiency Plan Review Guide for New Businesses* (5), *Increasing Water Efficiency in California's Commercial, Industrial, and Institutional (CII) Sector* (12), *Waste Not, Want Not* (4), *Water Efficiency Guide for Business Managers and Facility Engineers* (13), and many more resources.

Examples of water savings opportunities by end use include, but are not limited to:

- Indoor/Domestic Water
  - Install high-efficiency dishwashing equipment and run only when full. Install high-efficiency pre-rinse spray valves.
  - Install a garbage strainer instead of a garbage disposal.
  - Use air-cooled flake ice machines.
  - Retrofit restrooms with high-efficiency toilets, urinals, lavatory faucets, and showerheads.
  - Install high-efficiency clothes washing machines in laundry operations and run only when full.
  - Assure that steam sterilizers are equipped with tempering water flow controls.
- Cooling and Heating
  - Optimize cooling tower performance to achieve the maximum cycles of concentration.
  - Consider alternative sources of water for cooling tower makeup.
  - Eliminate the use of single-pass cooling.
  - Return steam condensate to the boiler.
- Outdoor Water Use
  - Use a weather-based irrigation control or soil moisture sensor for automatic irrigation system control.
  - Choose native, drought-resistant plants for landscaping.
  - Audit and optimize irrigation systems to achieve maximum distribution uniformity of water.

According to a McGraw-Hill Construction market report, the most-used water-efficiency practices in the CI sector are automatic irrigation systems, high-efficiency urinals, water-saving bathroom sink faucets, water-saving showerheads, and less water-intensive plant species in landscaping. (14)

Market research conducted by McGraw-Hill Construction on water use in buildings has found that water efficiency is growing in the CI sector. The study found that most building engineers are motivated by the reduction in energy use and utility bills that is coupled with many water-efficient practices. In the next five years, McGraw-Hill Construction estimates that 50 percent of building managers will incorporate water-efficient practices into half of their building portfolio. McGraw-Hill Construction calls for benchmark setting, government drivers, and education to continue to push CI sector water efficiency. (14)

Changes made in the Uniform Plumbing Code and local plumbing codes have mandated reductions in water use in plumbing fixtures such as toilets, faucets, wash basins, and urinals. These codes have significantly reduced water demand in newer buildings or renovations. Additional efforts are needed to incentivize retrofits of older buildings that were grandfathered into these codes. Significant water savings are possible by focusing on replacing the older, inefficient plumbing fixtures in these buildings.

In addition, local governments around the country have enacted restrictions and ordinances to reduce water use throughout the municipality during times of drought. These efforts often

include restrictions on outdoor water use, water efficiency requirements on fixtures, and mandatory use of certain BMPs. Overall, these ordinances have been effective in reducing water demand during times of strained supply. Unfortunately, behavior changes are not often sustained, as many people return to their old water-using behaviors as soon as the restrictions are lifted. Additional efforts are needed to educate consumers on the importance of water use in all situations, not just during drought. Water conservation and efficiency programs should make an effort to create some distance between the programs' efforts and the drought restrictions so that consumers do not automatically associate the two. This education may be easier in traditionally arid regions but will remain important to conduct in water rich areas too.

III. Existing Commercial and Institutional Efficiency Programs

WaterSense intends to learn from the success and challenges faced by historical and existing programs, including national, regional, local, subsector-specific, and international CI sector efficiency programs discussed in this section.

III.A National Programs

A few national-level programs do exist that challenge the CI sector to save water and/or energy. WaterSense can learn from these programs by closely evaluating the program structures that are applicable at a national level.

III.A.i EPA's Water Alliances for Voluntary Efficiency (WAVE) Program

The WAVE program was established by EPA's Office of Water in 1992. Its mission was to encourage commercial businesses and institutions to reduce water consumption while increasing efficiency, profitability, and competitiveness. The program provided education to the hospitality industry, office buildings, schools, and universities on water conservation through water use tracking software and other tools. It also provided some marketing support to its partners while allowing them to use the WAVE program logo.

Over several years, many partners, supporters, and endorsers participated in WAVE and achieved many successes. While the program assisted numerous facilities in reducing their water consumption, unfortunately, the program structure was unsustainable over a longer timeframe. The majority of the program's funding concentrated on developing software for each subsector. While this software was very useful to the participating partners, few resources were left to support implementing the program itself. Eventually, this hindered the program's ability to respond to participants' needs, so while the WAVE software is still distributed by request, the program has been phased out over the last few years.

III.A.ii EPA's Water Efficiency Leaders (WEL) Awards Program

EPA initiated the WEL awards in 2006 to recognize those organizations and individuals who provided leadership and innovation in promoting water-efficient products and practices. WEL's stated goal was to help foster a nationwide ethic of water efficiency, as well as to inspire, motivate, and recognize efforts to improve water efficiency. WEL award recipients were selected from a nomination process and had to be located within the United States and fit into one of four

categories: corporate/industry, organizations/teams/institutions, individuals, and government/military.

The WEL program is currently on hiatus while EPA evaluates the relationship between WEL and the WaterSense program. At a minimum, the awards and recognition efforts of the two programs will be more focused and coordinated.

III.A.iii ENERGY STAR® Buildings and Plants

ENERGY STAR is a joint program of EPA and the U.S. Department of Energy (DOE) that is working to help businesses and consumers save money and protect the environment through energy-efficient products and practices. ENERGY STAR for Buildings and Plants gives organizations of all types the tools to track and improve their energy performance. The program has many components, including a certification and labeling aspect, subsector-specific technical assistance documents and tools, awards, and challenges. (8)

Under the labeling program, ENERGY STAR benchmarks existing commercial facilities using a 1 to 100 point rating system to measure the energy use of a building relative to its peers while accounting for location and climate. Buildings achieving a score of 75 or higher and verified by a professional engineer are eligible to earn the ENERGY STAR label. The facility-specific information is collected through ENERGY STAR's Portfolio Manager tool, which allows organizations to input their information directly online. New construction can be designed to receive the ENERGY STAR label. Architectural firms must submit documentation to ENERGY STAR to receive the label. Once facilities earn the ENERGY STAR label, they are eligible to apply for annual awards and receive other public recognition during media building spotlights. ENERGY STAR's Web site keeps a comprehensive list of labeled facilities, including a list of the top 25 cities with the most ENERGY STAR labeled buildings. (8)

ENERGY STAR's Buildings and Plants program has significant technical resources available for the entire CI sector and specific information by subsector. Tools and resources are available on energy management guidance, assessing building and plant energy efficiency, assessing commercial building designs, improving building performance, and cost-benefit calculators. In addition, facilities can find a list of service providers who can assist them in meeting the ENERGY STAR labeling requirements for buildings. The energy performance of the facility is verified by a professional engineer to ensure that it is accurately measured. The ENERGY STAR Web site also provides a list of energy efficiency programs that offer technical and financial assistance to the CI and industrial sector. In addition, subsector-specific guidance is available to help commercial facilities in many subsectors get started with energy efficiency. (8)

An additional component, the ENERGY STAR Challenge, is an ongoing program to encourage facilities to reduce their energy consumption by 10 percent. More specific challenges are also offered. For example, architects can take the ENERGY STAR Challenge to design a building for the ENERGY STAR label. (8)

III.A.iv Leadership in Energy and Environmental Design (LEED)

LEED, a third-party certification program sponsored by the U.S. Green Building Council, is a rating system for all building types. The LEED program works to reduce a building's

environmental impact throughout its life cycle including its design and construction, operations and maintenance, tenant fitout (or customized interior construction for occupying tenants), and significant retrofits. Separate LEED rating systems address new construction, core and shell, schools, healthcare, retail, commercial interiors, retail interiors, existing buildings, and existing schools. Each type of LEED certification program has its own resources and checklist of actions needed to achieve a LEED rating. LEED takes a multi-faceted approach to recognize performance in five areas of sustainability: sustainable site development, water efficiency, energy efficiency, materials selection, and indoor environmental quality. Every improvement adds a designated number of points, which determine the level of certification the building receives, whether it is simply certified, or achieves silver, gold, or platinum. Water efficiency makes up five of the possible 70 points a building may receive to be certified. Each point can be earned for an overall percent reduction in water usage or the implementation of a best practice such as the use of recycled water for landscape irrigation. Although this model is successful in improving the overall environmental performance of a building, it does not necessarily ensure a reduction in all areas of environmental impact. For example, because architects and/or building owners are able to choose which projects to implement, a building may be certified with no water-efficient practices implemented at all. (9)

III.A.v Federal Facilities Under Executive Order 13423

Nationwide, federal facilities have been working to reduce their water use for many years under a series of executive orders (E.O.s). Most federal facilities are categorized as institutional buildings with some exceptions for military operations and repair facilities. Because of the large number of facilities owned and operated by the federal government, there is enormous potential for water reduction. E.O. 13423, “Strengthening Federal Environmental, Energy, and Transportation Management,” defines specific water conservation requirements for all federal facilities. According to E.O. 13423, beginning in FY 2008, agencies must reduce water consumption intensity (on a gallons per gross square foot basis), relative to the baseline of the agency’s water use intensity in FY 2007, through life cycle cost-effective measures by 2 percent annually or 16 percent total by the end of FY 2015. (10) Several options are available for federal facilities to utilize when implementing this requirement, including water assessments, development of water management plans, and purchase of water-efficient fixtures. The WaterSense program worked with the Federal Energy Management Program (FEMP) to develop BMPs to assist federal facilities in implementing this E.O. (28)

Each federal agency designs its internal water-efficiency program to meet this E.O. requirement. For example, EPA developed a comprehensive water conservation strategy to assure that it meets its goals. (29) EPA’s strategy entails assessing each of its facilities, using the FEMP BMPs as a guideline, to develop a water use baseline and identify facility-specific water savings opportunities. From the assessments, water management plans are developed for each facility that indicate the facility’s benchmark and provide a path for water savings. Facilities are encouraged to complete projects identified during the assessments, which may include installing water-efficient fixtures, optimizing cooling tower performance, collecting air handler condensate and using it as cooling tower makeup water, or discontinuing single-pass cooling and unnecessary tempering water use. In addition, EPA sets facility-specific water reduction targets annually to encourage facilities to practice continual improvement and meet each facility’s own potential.

III.B Regional and Local Programs

CI programs have been operating at the local level for many years. Local utilities and governments have focused their efforts on the CI sector utilizing a combination of water audits and rebates to achieve results with their customers. Prominent programs include those sponsored by Seattle Public Utilities, EBMUD, the Massachusetts Water Resources Authority, the Metropolitan Water District of Southern California, the City of San Jose Environmental Services Department, the City of Austin and Austin Water, the City of Phoenix, and Denver Water. Case studies and presentations by staff from these organizations outline some of the successes achieved by the programs. All significantly reduced the water used by their CI customers. Three prominent programs are discussed in detail below, though many more are offered nationwide.

III.B.i East Bay Municipal Utility District

EBMUD's WaterSmart Non-Residential Conservation Program seeks to reduce CI and industrial sector water use through a variety of program options. EBMUD offers financial incentives in the form of rebates to customers in these sectors for installing high-efficiency clothes washers in multi-family properties and coin laundry stores, high-efficiency water brooms, and high-efficiency toilets. Open rebates are also offered for up to one-half of the installed cost of equipment that improves water efficiency, such as retrofitting cooling towers and replacing single-pass cooling. Several incentives are offered with regards to irrigation. EBMUD offers free irrigation surveys to all commercial customers. It also offers rebates for matched precipitation rate sprinkler heads, rotating nozzles, moisture sensors, weather-based controllers, and sub-meters as long as the site was surveyed and water savings opportunities were identified. Under the Irrigation Reduction Information System, free customized water budgets are printed on customers' water bills. EBMUD also offers free product give-a-ways during water surveys or to be picked up from the utility's office. Free products include 2.0 gallons per minute (gpm) showerheads, 1.0 gpm bathroom faucet aerators, 1.5 kitchen faucet aerators, toilet tank displacement bags, and hose nozzles. EBMUD will replace conventional pre-rinse spray valves in commercial kitchens with high-efficiency models through its direct-install program. It also offers the WaterSmart Guidebook (5), workshops, events, and links to many water-efficiency resources as part of its education and outreach program. (24)

III.B.ii San Antonio Water System

The San Antonio Water System (SAWS) has a Commercial Conservation Rebates and Audits Program to assist commercial customers with water conservation. Ten percent of SAWS customer base are commercial customers, and they account for 40 percent of SAWS annual water sales. The large-scale rebate offered by SAWS will rebate up to 50 percent of the cost of new water-saving equipment. The rebate is determined by the actual water savings, the life of the equipment, and the installed cost. SAWS also has a high-efficiency toilet distribution program, in which high-efficiency toilets are provided to commercial customers for free and installed in nonprofit organizations for free. The program also boasts free cooling tower audits and optimization suggestions.

In addition, SAWS has two certification programs—one for car washes and one for restaurants. The Certified WaterSaver Program for car washes requires interested car washes to meet

certain criteria during an inspection. They are then eligible to receive the signage indicating that they are a "Recognized WaterSaver Partner." They must reapply each year and are subject to random inspection throughout the year. If discrepancies are found, they have 30 days to fix the discrepancy. Partners are eligible to receive a 10 percent discount on their monthly sewer bill and are required to sponsor some charity car washes. The Restaurant Certified WaterSaver Program requires three simple things—pre-rinse spray valves must be 1.6 gpm or less, toilets must be 1.6 gallons per flush (gpf) or less, and all ice machines must be air-cooled. If a restaurant does not meet the requirements, it can receive pre-rinse spray valves and high-efficiency toilets free of charge if it would like to become a Certified WaterSaver. Rebates for air-cooled ice machines are for 50 percent of the product cost.

Finally, SAWS also has a program called "Gold Fore SA." Golf courses are evaluated on water conservation, water quality, wildlife habitat and open spaces, and community outreach. There are four levels of achievement—par, birdie, eagle, and double eagle—and each level has increasingly more difficult program requirements for each of the four evaluation categories. The golf course must pledge to commit to the program, evaluate the course based on program criteria, develop a three-year plan for continuous improvement, and meet schedules and milestones. Golf courses that meet birdie level or better receive the "Good Housekeeping Seal." (25)

III.B.iii City of Austin

Similar to the other programs, the City of Austin provides several rebates to commercial customers, including high-efficiency toilets, high-efficiency urinals, high-efficiency clothes washers, rain barrels, larger capacity rainwater harvesting systems, and pressure-regulating valves. The program offers rebates to commercial laundries for the purchase of ozone and water reuse equipment. The amount of the rebate is equal to the amount of water saved, equal to $1 per gallon saved per day or up to half of the equipment cost, whichever is less. Similar to SAWS, it offers free water evaluations for commercial customers to identify water savings opportunities and eligibility for rebates. The city offers rebates to CI and industrial customers that install new equipment and processes that conserve water in existing facilities. Projects must be approved and customers can receive up to $100,000. The city offers free irrigation audits and rebates for implementing recommendations made during the audit, as well as educational resources, programs, and newsletters. (26)

III.C Subsector-Specific Programs

Different subsectors have developed initiatives focused on improving sustainability, many of which include elements on water efficiency. Examples include the Laboratories for the 21st Century (Labs21) program operated by EPA and DOE (30), Practice Greenhealth (formerly Hospitals for a Healthy Environment) (31), and the new Sustainability Tracking, Assessment & Rating System (STARS) effort (32) managed by the Association for the Advancement of Sustainability in Higher Education.

Several water-efficiency initiatives have been implemented throughout the years in hotels and restaurants. Some of the most successful so far have been the efforts to reduce the environmental impact of hotels. Many hotels have created systems to reduce the number of times the linens are washed during a customer's stay. These efforts have significantly reduced

water use through their laundry and cleaning operations. In some areas of the country, these practices have been required under a city ordinance or plumbing codes, especially during times of drought and water restrictions. Organizations such as the "Green" Hotels Association offer membership opportunities and provide free literature detailing conservation opportunities for those hotels willing to make sustainable choices. (2)

Efforts dedicated to promoting green restaurants have also been on the rise. The nationwide Green Restaurant Association (GRA) provides environmental assessments, environmental consulting, and certification of green restaurants using its Green Restaurant® 4.0 standards. The standards allow restaurants to collect points in the following areas: water efficiency, waste reduction and recycling, sustainable furnishing and building materials, sustainable food, energy, disposables, and chemical and pollution reduction. The program is a tiered structure offering two-, three-, and four-star ratings, but each restaurant must meet minimum points in every category. There are three types of certification options: existing restaurants, new builds, and events. GRA verifies each step with invoices and other documentation to ensure that each restaurant has reached the minimum points for certification. Recertification occurs each year if a restaurant maintains good standing with Green Restaurant® 4.0. (22)

In addition to the GRA at the national level, the Environmental Law and Policy Center of the Midwest developed an organization to recognize green restaurants in Chicago. The Web site (www.greenrestaurants.org/index.php) provides a detailed guide for how to become a green restaurant, calling out specific areas to save water and energy and practice other sustainable business operations in restaurants. Although a list of green restaurants in Chicago is provided, the method for determining how they are green is not clear on the Web site. (23)

III.D International Programs

Internationally, regional or national CI sector water programs have been developed in Canada, Australia, and the United Kingdom (UK).

The province of Ontario, Canada is operating under a June 2009 *Blueprint for a Comprehensive Water Conservation Strategy.* (15) The blueprint describes the need for a comprehensive water conservation plan and outlines the elements of a successful plan that Ontario will follow. The elements include: oversight, targets and plans, measuring progress, water budgets and baseline data, benchmarks, BMPs, financial incentives, social and technical capacity, market transformation, and education.

The City of Toronto has its own CI program called the WaterSaver Program, which offers high-efficiency toilet and clothes washer rebates, in addition to an extensive water buy-back program. Under the buy-back program, the city provides a one-time financial incentive of 30 cents per liter per day (e.g., $1.14 per gallon) to businesses that make permanent and measurable water reducing changes to their operations. City staff works collaboratively with businesses to identify areas where water is wasted and offers solutions that will permanently reduce water use and wastewater discharge. The goal of this program is to help reduce water use citywide by 15 percent by 2011. Businesses reap rewards with lower water bills and utility costs and receive a cash incentive from the city that pays for a portion of their costs to install water-saving fixtures and equipment. (16)

In Australia, the state of New South Wales (NSW) offers a Green Business Program. The NSW Green Business Program provides $30 million throughout five years for projects that will save water and energy in business operations locally. Round one of the Green Business Program allocated $11.7 million to 24 water and energy projects, saving an estimated 164 million liters (e.g., 43 million gallons) of drinking water and 36,000 tonnes (e.g., 39,700 tons) of greenhouse gas emissions a year.

South Australia Water's Business Water Saver Program works with top water users throughout South Australia to identify opportunities to reduce water consumption and minimize wastewater production. For interested businesses that use more than 50 million liters (e.g., 13 million gallons) of water annually, South Australia Water provides water-efficiency audits, water-efficiency reporting, education and training, monitoring, and ongoing support. (18)

The Australian Capital Territory (ACT) has a program called Think Water, Act Water, which offers up to $20,000 for commercial bathroom retrofits. ACT also operates under a water conservation strategy and implementation plan, which sets a goal of reducing water use by 12 percent by 2013 and 25 percent by 2025. The plan calls for a variety of programs, including rebates, subsidies, purchasing labeled products (under the Water Efficiency Labeling and Standards Scheme, 19), education, outreach, and more. (20)

Waterwise is a nonprofit, nongovernmental organization focused on decreasing water consumption in the UK and building the evidence base for large-scale water efficiency. Waterwise set up the Saving Water in Scotland Network, a partnership seeking to identify and implement water-efficiency strategies. Waterwise awards the Marque award annually to water-using products that highlight water efficiency or reduce water waste and work with UK water companies on large-scale water-efficiency projects, ranging from water audits to domestic retrofit schemes. The organization also provides technical information and assistance to businesses and the government, among others. (21)

IV. Key Stakeholder Groups

WaterSense can learn from the experiences of other CI sector programs but also seeks to engage partners and other stakeholders in the CI sector program development process. After reviewing possible stakeholder categories, seven major categories of stakeholders have emerged to potentially participate in program development: managers and implementers of existing CI programs; water, wastewater, and energy utilities; manufacturers and distributors of commercial water-efficient products; commercial builders, developers, specifiers, and architects; experienced CI water auditors; leaders, building owners, facilities managers, and water-efficiency specialists from all CI sector organizations; and federal agency water-efficiency leaders. These groups represent the likely decision-makers and target audiences of a national CI sector program.

- Existing Program Contacts. Managers and implementers with first-hand experience developing and implementing a CI sector program can offer extensive input on potential and real implementation issues, as well as identify ways to overcome barriers.

- Water, Wastewater, and Energy Utilities. Water utilities are likely to serve a critical role in promoting a national program, and their input should be solicited during the development

phase of the program to ensure buy-in. A broad geographic representation of major utilities can help identify regional or local issues of concern. Utilities can be represented individually and/or by organizations such as the Alliance for Water Efficiency and AWWA. In addition to water utilities, wastewater and energy utilities serve as valuable stakeholders because water efficiency, reduced wastewater discharge, and energy efficiency are co-benefits to any CI water-efficiency effort. Energy utilities may also have experience to share about their CI programs.

- Manufacturers and Distributors. Manufacturers (along with members of their distribution chain) of appliances, plumbing fixtures and systems, irrigation systems, etc. can become strong allies for a national water-efficiency program for the CI sector. Their support is critical to program success and early buy-in should be solicited. They can be present as individual companies (e.g., American Standard) and/or be represented by trade associations such as the Plumbing Manufacturers Institute.

- Commercial Builders, Developers, Specifiers, and Architects. Commercial builders and developers are a key target audience and should assist with CI program development. Builders, developers, specifiers and architects can provide EPA with critical input on specifications that they can/would be willing to meet. This audience can be individuals or be represented by a trade association.

- Experienced CI Water Auditors. Not all facilities receive water audits to determine their water balance and identify water-efficiency and conservation opportunities. Water auditors should be engaged in the CI program development process as they understand CI sector water use and end water uses.

- Leaders, Building Owners, Facilities Managers, and Water-Efficiency Specialists From all CI Sector Organizations. Leaders, building owners, facilities managers, and water-efficiency specialists with office corporations, schools, hotels/motels, and all CI sector organizations know the ins and outs of their CI subsectors and facilities and can determine what program components and structures are reasonable and attainable. They can provide EPA with further input on subsector baselines, end uses of water, and potential barriers to implementation. They may be individuals and/or be represented by a larger corporate body or trade association.

- Federal Agency Water-Efficiency Leaders. Federal agencies currently working to optimize their facilities to meet E.O. 13423 requirements may have useful insight for a national CI program structure.

V. WaterSense Commercial and Institutional Program Design Options

In designing a national CI sector water-efficiency program, WaterSense will need to consider the types of organizations to which program would apply and how the program will be structured, e.g., a labeling program versus a voluntary commitment program. This section presents several design options and key issues to consider.

V.A Scope and Eligibility

WaterSense could develop a CI program that would be applicable to the entire CI sector or phase in one subsector at a time.

- Developing a broad CI sector program. Under this approach, all CI organizations would be eligible to participate in this program. EPA could take advantage of subsector-specific strategies to promote end use water efficiency while targeting subsectors through portions of the program, but all subsectors would be included in the program from the outset. Under a broad approach, EPA could structure the program around common end uses that are applicable across most sectors, e.g., domestic water use, landscape water use, and heating and cooling. EPA could link tools and guidance to BMPs for each type of end use. The BMPs could be focused on the highest consumptive end uses to achieve the greatest results; for example, cooling tower optimization and sanitary fixture retrofits. EPA could broadly distribute this information among the different types of organizations and implement the program simultaneously.

  Advantages:
  - Economies of scale gained by working with a large number of organizations on similar issues.
  - Encourages information sharing between different types of participating organizations.
  - Cross-sector applicability—solutions implemented in one area may be applicable to many others who have not considered it.

  Challenges:
  - Target decision-makers, operating procedures, and investment styles vary by sector.
  - Specific technologies or practices may not be transferable to another organization.
  - Other barriers to implementation may exist in particular sectors.

- Phased subsector-by-subsector approach. EPA could initiate a CI water-efficiency program one subsector at a time. This approach would allow EPA to focus initially on subsectors that have a high potential for improvements in water efficiency and to develop tools and resources specific to their needs. As the WaterSense CI program expands, EPA could expand into new subsectors and tailor the program and resources as necessary. By implementing a subsector-based approach, a national-level program will be able to provide specific information targeted to each type of organization in the CI sector. BMPs can be tailored to standard operating styles and procedures to increase implementation rates. Outreach materials and participation incentives can be targeted to the key decision-makers in each type of organization. If the highest water-using organizations are targeted first, large water reductions may be possible, fueling further results.

Advantages:

- Focusing limited resources (i.e., staff and funding) may make implementation more effective.
- Targeted information and resources may increase program adoption rates and improve results.
- Large water reductions may be possible in certain sectors, creating momentum for further results.

Challenges:

- Coordination between types of organizations may be difficult due to differences in operating styles and structures as well as adoption rates.
- Certain organizations may fall within multiple subsectors, complicating implementation.
- All subsectors will not receive immediate attention, and it may take many years to reach all subsectors. EPA could miss out on immediate and impactful water savings opportunities in some subsectors using this approach.

If choosing a subsector to target, EPA would utilize a combination of factors to ensure that the program is implemented as effectively as possible to reduce implementation barriers and maximize results. In the CI sector, the following factors would most likely be considered:

- Relative water use within CI sector.
- Water use intensity.
- Water-efficiency potential.
- Willingness to participate in a water-efficiency program.
- Concentration of customers in a subsector.
- Possible connections to existing efforts and programs (i.e. green hotel associations, local conservation programs).
- Cross-sector applicability of tools and resources.
- Measurability of results.

V.B Program Structure

EPA is considering several basic program structure options for a potential WaterSense CI program including: certification and labeling, partnership commitment, or education and outreach. This section describes each of these program structure options including a discussion of key design issues that need to be addressed. While these programs are discussed separately, combinations of program structures are possible depending on the scope of the program and the stakeholders involved. Regardless of the structure created, EPA would want to design tools to effectively target the identified barriers to implementation of water efficiency in these sectors.

V.B.i Certification and Labeling Program

EPA could create a national-level certification and labeling program by developing specifications for facilities in the CI sector. Upon meeting the specification, the facility would receive the WaterSense label. Similar programs include ENERGY STAR Buildings and Plants and LEED.

Key Design Issues to Consider

Third-Party Certification Versus Self-Declaration

Under this program structure, EPA would have to determine if a facility's performance would be verified by a third-party or through a self-declaration process. Several of the national-level resource conservation programs, including ENERGY STAR, use a self-declaration system. In the case of ENERGY STAR, information is entered into a tracking system and approved by a staff engineer at the facility. Other programs such as LEED require facility inspections. EPA could require third parties to conduct inspections in order to mirror the rigor of other parts of the WaterSense program. In fact, networks of inspectors may already exist through building inspection and code enforcement requirements that could be tapped to provide such verification. Alternatively, a tool such as ENERGY STAR's Portfolio Manager could be used to track facility performance. While a third-party certification system would be the most resource intensive, it would provide the most accurate and tangible water use reductions.

Single-Tiered Versus Multi-Tiered Rating Program

EPA could apply a certification and labeling structure using a single-tiered or a multi-tiered rating system. Under a single-tiered system, organizations could meet the specification, but there would be no differentiation among levels of achievement. Conversely, a tiered rating system would allow organizations to earn points by implementing certain BMPs or achieving water reduction levels, and the organization would receive an overall score based on the sum of its points. Many existing programs use this tiered model to reward the highest achievers, but make the program accessible to a broader range of facilities. The LEED model has been widely adopted with excellent results verified by inspectors. Other programs use more informal rating systems that do not require inspection. A tiered system that rewards various levels of water conservation could aim to complement similar national-level programs. While a tiered system would increase participation, it also could be more resource intensive and complicated to implement.

New Construction Versus Existing Facilities

EPA would consider whether the program would include new commercial facility construction or new and existing facilities. Certain technologies lend themselves better to new construction rather than retrofits. Older facilities may have additional opportunities for saving water by updating equipment, fixing leaks, and other measures that new facilities might not find necessary for water efficiency. Specifications could allow for a facility to be built or retrofit to meet the same specification, or separate specifications could be considered similar to the LEED framework. While working with new facilities could be easier, existing buildings may have greater potential for water-efficiency improvements.

Labeling Criteria

Labeling criteria would be outlined in a specification that could include requirements for water use or water consumption intensity (on a gallons per gross square foot basis) percentage reduction and/or BMP implementation.

The percentage reduction approach would require the facility to determine baseline water use with metered data or other mechanisms, and a data collection procedure would need to be developed. EPA could require that facilities reduce their water use or water use intensity by a certain percentage within a specified number of years in order to receive the label. In order to reflect subsectors with different end uses and water consumption patterns and levels of engagement in existing water-efficiency programs, WaterSense could set percent reduction targets by subsector. Using this approach, WaterSense could survey each subsector to determine an appropriate baseline and percentage reduction target. This flexibility could maintain realistic, yet rigorous standards for each subsector while encouraging the participation of more facilities.

In a specification, EPA could also require the implementation of BMPs by participating facilities. Facilities could be measured based on the implementation of technologies, water use reduction strategies, or other best practices. The program could require facilities to meet a set of specified BMPs or allow them to choose from a broad list of BMPs or water use reduction strategies developed by WaterSense in order to receive the label. The BMPs could apply to the entire CI sector or could be subsector-specific. BMPs could also be provided as a guide to meeting percent reduction targets discussed.

V.B.ii Partnership Commitment

Under a partnership program option, organizations would partner with WaterSense to improve the water efficiency of their facilities. Using a commitment-based approach, organizations could sign up as WaterSense partners and commit to undertaking specific actions. There would be no labeling process but organizations could be required to report their annual activities and water use savings. While this program structure is not necessarily as rigorous as a facility specification and certification, it could result in extensive water savings if combined with technical assistance or third-party verification.

Programs utilizing this structure have been under increasing scrutiny lately to demonstrate results. If using this program structure, WaterSense would need to ensure that the performance of participating facilities is independently verified along with the progress toward meeting their commitments. Regulatory flexibility would not be included in the program structure and mechanisms would be created to remove non-performing facilities from the program on a regular basis.

Key Design Issues to Consider

Program Commitment

Under a partnership-commitment program, organizations could commit to reducing their water use or water use intensity by a certain percentage. Alternatively, they could only commit to implementing BMPs at their facility.

Commitments could be selected by EPA or self-defined by the facility. Either percentage reduction or BMP commitments outlined by WaterSense could be for the entire CI sector or subsector-specific. Alternatively, EPA could choose to allow facilities to set completely

customized goals for water reduction. This option allows the organization to decide a reasonable goal to achieve that may most benefit their facility.

Technical Assistance

In order to assist facilities in meeting their partnership commitments, EPA could partner with other organizations to provide onsite assistance to help organizations identify facility-specific goals and implement projects to achieve them.

In order to facilitate this structure, a network of state and local technical assistance providers from existing water and pollution prevention programs could be tapped to provide assistance to buildings in their area. These partner organizations could either provide the technical assistance themselves or train individual providers to support the water-efficient design, operation, and maintenance of CI facilities in a similar manner to they system set up for WaterSense Single-Family New Homes.[3] Providers could be trained and certified to assist in the implementation of water-efficiency audits, BMPs, fixture retrofits, and other water conservation assistance. The training would have to be developed by a reputable source, such as EPA or the U.S. Green Building Council, and administered through trade associations or other large organizations. The trained and certified providers could be centrally listed and promoted in multiple locations.

Similar networks of technical assistance providers currently exist through several energy programs, but none is specifically focused on water conservation. The ENERGY STAR program lists energy providers on its Web site, while LEED uses qualified inspectors to inspect and certify buildings on a multimedia basis. It may be possible to utilize many of the same providers to deliver water-efficiency assistance at the same time they are promoting energy conservation. DOE conducts a similar program through its Industrial Assessment Centers, which train and qualify providers to assist companies in reducing their energy usage. DOE's training is quite extensive, allowing providers to focus on particular end uses at facilities. Some of these trainings may be easily adapted to include water components as well as energy. One example would be the section focused on heating and cooling systems, which providers could use to advocate multiple-pass cooling systems and other water-saving measures. This connection between the energy providers and water efficiency is especially appropriate, due to the extensive amounts of energy used to heat and pump water throughout a facility.

In addition to technical assistance programs focused on energy, many pollution prevention programs exist around the country which already assist CI facilities to reduce their overall environmental impact. Because these technical assistance programs have very different levels of resources and areas of focus, specific resources would be needed to assist these programs in talking about the WaterSense program and facilitate their work with facilities to improve their water efficiency. Overall, the extensive expertise of these established programs and their existing relationships with CI facilities may be very useful in spreading information about a WaterSense CI program while also improving the effectiveness of its implementation.

[3] For more information about the structure of the WaterSense New Homes program, please visit the WaterSense Web site at www.epa.gov/watersense/pp/new_homes.htm.

Reporting Requirements and Verification

To track water saved through the program, EPA could require organizations to submit an annual report to WaterSense on the progress made toward their goals, be it percentage reduction commitments, BMP implementation, or facility-defined goals. Under this approach, EPA could use data provided by the facilities to approximate water savings through use of online tools such as ENERGY STAR's Portfolio Manager. Third-parties such as water utilities could verify the reductions.

V.B.iii Education and Outreach

WaterSense could choose to develop an education and outreach program that would focus on educating decision-makers (e.g., product specifiers, facility managers, building owners, corporate leaders) on WaterSense program concerns (e.g., the value of water-efficient products and practices).

Key Design Issues to Consider

Level of Technical Assistance

This type of program could include technical assistance resources developed by WaterSense, as well as technical assistance provided through partnerships with regional, state, and local organizations, as well as universities. EPA could provide centralized access to tools and resources relevant to reducing water use in the CI sector. These resources could include BMPs applicable to different types of facilities as well as specific technologies that could be utilized to gain reductions. Many similar technical assistance resources are currently available through different vehicles, but some may need to be modified to be applied to CI facilities. Tools could guide facilities through water use audits, cost-benefit analyses, water use projections, leak detection and repair, and other useful topics. Training manuals and guidance documents could be created along with new calculators and online tools such as ENERGY STAR's Portfolio Manager.

Motivation and Incentives

Since this program is neither a labeling program nor a partnership program, WaterSense would need to put incentives in place to motivate CI sector participation. Experience has shown that formal national recognition through an awards program and the media spurs action. Programs using this method, such as Green Chemistry and WEL, publicly recognize organizations that excel in achieving results aligned with program goals. WaterSense could combine its efforts with the WEL program to specifically create a CI awards program in which organizations submit project descriptions and water savings results. EPA could define award criteria to drive certain activities, and awards could be given on an annual or semi-annual basis. It should be noted that such an awards program could be a component of any program design that might be developed by EPA.

VI. Information Gaps and Outstanding Questions

WaterSense is interested in any data or information on the CI sector that is not presented in this report or included as a reference. EPA can consider information from studies that are more local or regional in scope; however, the Agency will need to be able to roll up the results to paint a national picture that can used for developing a national program. If WaterSense should choose a subsector approach, research will be needed to determine the current state of some subsectors and their water use baseline and water conservation potentials.

Specific research and data needs include:

- Subsector specific data, such as:
  - Water usage by facility and end use
  - Existing benchmarks with which to set targets
  - Capacity and resources available of potentially participating facilities

- Economic data, such as:
  - Capital versus long-term operating costs
  - Other economic considerations in commercial facilities
  - Impacts of commercial rate structures on efficiency
  - Other potential incentives

Information is also requested on potential partners who may assist WaterSense in distributing information, analyzing sector data and potential participation, and providing technical assistance to facilities.

WaterSense would like its partners and stakeholders to be involved in development of a CI sector program and asks stakeholders to consider WaterSense's national scope and program goals when submitting comments. WaterSense in particularly interested in receiving feedback on the following areas and questions:

<u>Data Gaps and Research Needs</u>

- What research needs to be done or data collected on the CI sector? What information gaps exist?

- Are you aware of any reliable data that is not cited in this paper and could add substantially to our understanding of water use in the CI sector?

- If EPA were to set a water use percent reduction target for the CI sector as a whole or for specific subsectors, what should EPA use as the water use baseline and what percent reduction should be targeted?

- What impact could a national sector water-efficiency program have on the revenue and rate structure of drinking water utilities?

- What issues and barriers stand in the way of a national CI sector water-efficiency program? How can EPA overcome them?

Program Design Options

- Should EPA address all subsectors together or separately?
- Are the factors for choosing a subsector appropriate?
- What are the pros and cons of each program structure presented?
- What program structure do you think EPA should adopt and why?
- Is it important to have WaterSense labeled CI sector facilities?
- If a certification and labeling scheme is preferred, should EPA have a single-tiered or multi-tiered program? Should certification be third-party or self declaration? Should a specification include percentage reduction requirements, best management practices (BMP) implementation requirements, or both?
- If EPA chose a partnership-commitment program structure, what should the commitment be? What reporting should be required?
- If EPA offered technical assistance, what should it be and in what form should it be offered?
- If a subsector-specific approach is chosen, should EPA's efforts focus on the largest overall users of water, or on the largest individual accounts?
- If a subsector-specific approach is chosen, what factors should be considered in prioritizing different subsectors?
- Should EPA offer an awards program?
- What other incentives should EPA offer for participating in the program?

VII. Next Steps

EPA is welcoming comments on the above questions and the following white paper. Comments may be submitted to watersense-ci@erg.com through September 20, 2009.

WaterSense will also be holding a meeting to discuss potential CI program options in conjunction with the WaterSmart Innovations conference in Las Vegas, Nevada. If you are interested in attending this meeting please contact the WaterSense Helpline at (866) WTR-SENS (987-7367) or watersense@epa.gov.

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Appendix A:

CI Water Use by Subsector

While data regarding water use in the CI sector is not regularly collected and monitored, studies have been done on the regional and national level. The following is a summary of the best available studies on this subject.

The *Waste Not, Want Not* study examined CI subsector water use in California in 2000. (4) Table A1 presents these findings.

Table A1. Commercial Water Use in California in 2000

CI Subsector	Percent of CI Sector Water Use
Offices	18.3
Schools	13.5
Golf Courses	12.4
Restaurants	8.8
Retail	8.3
Hospitals	2.0
Hotels	1.6
Laundries	1.6
Unexamined Commercial	33.5

Source: Modified from Peter H. Gleick, et. al., *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003

According to this study, offices, schools, golf courses, restaurants, and retailers account for most of the CI sector water consumption in the state of California. Similar analysis has been done at the water utility level, but little other data exist to classify CI subsector water use at the state level.

The State of California Department of Water Resources, under a grant from EPA, surveyed a dozen water utilities in the United States to categorize water consumption from various CI subsectors in 1997. Table A2 summarizes the commercial and institutional water use of the participating utilities. (7)

The data presented in Table A2 have several anomalies because the individual utilities categorized their customers differently. The 1997 EPA grant study found that the largest water using subsectors are largely the same subsectors as those identified for the state of California from Table A1. In the 1997 study, hotels and motels were grouped with restaurants into a hospitality subsector that comprised approximately 15 percent of the water demand in the 12 communities studied. Additional significant water users in this study included offices (9 percent), healthcare (7 percent), education (5 percent), and a sales category that includes grocery and convenience stores (5 percent). (3)

As presented in the study *Commercial and Institutional End Uses of Water* (2000), billing information of five water agencies in Southern California and Arizona for a single year was evaluated. The study summarized the water use of facilities in 11 different subsectors which

were common to at least two of the five agencies (Table A3). The study further analyzed five of these categories to further disaggregate water uses and attempt to develop benchmarks. (3) The results of this study were very similar to the evaluation completed in the EPA study in 1997. Of note is that the 1997 study had several additional categories that may overlap with the 11 categories of the *Commercial & Institutional End Uses of Water* study. This difference highlights the difficulties in comparing the results of multiple studies. (3, 7)

Some of the disparities in the results from the two studies could be attributed to differences in the conditions at the locations examined. Several economic, technological, and climatic factors contribute to water consumption in these types of facilities. Economically, the growth or recession of local industry can change the demand for the services at a particular facility in the group. This will not only affect the water used by employees, but also the amount of water used by patrons who visit the facility. In addition to the changes in the overall demand of water within the facility, the price of water will also affect the amount of water used. Facilities will be more likely to reduce their water consumption if their water rates increase.

Similarly, the technologies used within the facilities will also affect the water use rates. Areas with newer buildings and more efficient technologies will have significantly lower water consumption rates than older buildings. Finally, the climate of the area can significantly affect the amount of water needed to operate a facility by changing the amount of water needed for irrigation and cooling. For example, the *Commercial and Institutional End Uses of Water* study only utilized information from facilities in California and Arizona, which may have higher irrigation needs than a group of communities from a more diversified set of locations. All of these factors combine to change the water consumption rates in different facilities making it almost impossible to make an equitable comparison.

Table A2. Distribution of CI Water Use by Subsector in Selected Cities as Reported in 1997

Subsector	Austin TX 1992	Buffalo NY 1995	Burbank CA 1995	EBMUD CA 1994	Glendale CA 1995	Miami FL 1995	Orlando FL 1995	Portland OR 1995	San Diego CA 1995	Santa Monica CA 1995	St. Paul MN 1994-1995	Santa Rosa CA 1994	Weighted Average 1992-1995
Percent of All Reported CI Water Use													
Commercial Water Use by Subsector													
Hospitality [a]	13.26	20.94	11.75	7.94	13.45	17.53	34.86	5.45	34.28	38.55	15.96	28.12	14.80
Warehousing	1.79	10.83		30.77	0.45	6.73	30.94	2.78	0.03		16.87	0.25	12.40
Offices [b]	13.97	15.81	11.37	7.09	12.78	12.29	9.7	5.69	7.59		13.03	15.4	9.20
Irrigation [c]	2.18	5.13		21.94	5.12		0.8	1.57	4.25	10.32	3.12	0.3	6.15
Miscellaneous Commercial [d]						31.05	0.45		0.06		0.46		5.72
Sales [e]	6.82	18.15	9.36	3.91	3.54	8.29	2.32	2.99	7.23	6.59	11.97	7.54	5.48
Services [f]	5.64	0.22	0.59	2.61	4.97		0.45	0.75	13.07		0.21	0.43	2.36
Laundries		3.41	3.52	2.53		2.89	2.13	1.10		3.91		5.88	1.73
Vehicle Dealers and Services	0.90	3.39	0.24	0.59	4.17	0.95	2.11	0.50	2.63	0.57	3.37	4.83	1.15
Meeting and Recreation [g]	0.96		2.48	2.13	9.59	0.26	0.53	0.01	2.17	3.14	4.98	0.44	1.11
Communication and Research	0.11	0.06	27.84	0.15	7.77		1.04		2.97	1.43	0	0.26	0.72
Landscape [h]	0.05	2.26	1.01	0.42			0.15	1.63				0.3	0.58
Transportation and Fuels		1.15		1.40	0.58		0.74	0			0.61	1.12	0.43
Car Wash		2.15	1.17	0.38	0.40		0.20		0.77	2.54	1.24	1.23	0.28
Passenger Terminals	0.45	1.17	2.31		0.05		0.01	0.30	0.22	0.33	0.16		0.20

Table A2. Distribution of CI Water Use by Subsector in Selected Cities as Reported in 1997

Subsector	Austin TX 1992	Buffalo NY 1995	Burbank CA 1995	EBMUD CA 1994	Glendale CA 1995	Miami FL 1995	Orlando FL 1995	Portland OR 1995	San Diego CA 1995	Santa Monica CA 1995	St. Paul MN 1994-1995	Santa Rosa CA 1994	Weighted Average 1992-1995
Institutional Water Use by Subsector													
Utilities and Infrastructure [i]	32.34	0.67	0.77	1.88	8.49		5.59	73.04	0.98		0.06	2.86	22.76
Health Care [j]	5.83	12.03	16.73	5.62	18.21	11.5	4.8	3.5	10.94	20.43	17.18	16.36	7.32
Education [k]	11.14	0.97	10.19	8.30	7.16	7.33	1.55	0.27	11.41	11.96	8.55	11.06	5.88
Church	1.43	0.31	0.67		2.70	1.18	0.70	0.42	1.19	0.21	1.49	2.79	0.73
Nonprofit Service and Organizations [l]		1.42		2.34	0.59		0.76		0.20		0.78	0.5	0.66
Military	2.42						0.02					0.33	0.27

Source: Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000 (originally derived from U.S. EPA, *Study of Potential Water Efficiency Improvements in Commercial Businesses*, Grant CX 823643-01-0 with the State of California Department of Water Resources, April 1997)

[a] – Hospitality includes restaurant/bar, overnight accommodations, and other group shelter.
[b] – Office includes finance, insurance, real estate, and government.
[c] – Irrigation includes parks, gardens, botanical, zoological, cemeteries, and open land.
[d] – Miscellaneous commercial includes warehousing, warehouse-cold storage, and boat dock.
[e] – Sales include grocery stores, convenience stores, and dry goods.
[f] – Services include miscellaneous repair services, crematories, funeral homes, laboratories, and printing.
[g] – Meeting and recreation include convention center, recreation and theaters, and amusement parks.
[h] – Landscape includes landscape horticultural service, agriculture, soil preparation, crop services, veterinary, equestrian, livestock, poultry, and game propagation.
[i] – Utilities and infrastructure include police and fire station, public works/utility, electric steam, natural gas, gas production and distribution, sanitary collection and disposal, construction, fumigating, and septic tank cleaning.
[j] – Health care includes health services, hospitals, and nursing homes.
[k] – Education includes schools, museums and libraries, colleges/other schools, and social services.
[l] – Nonprofit service and organizations include professional, labor, civic, and political social organizations except churches.

Table A3. Characteristics of Significant CI Subsectors in Five Participating Agencies

Subsector	Average Annual Daily Use (gpdc) [a]	Percent of Total CI Use (%)	Percent of CI Customers (%) [b]	Scaled Average Daily Use (gpdc) [c]
Urban Irrigation	2,596	28.48	30.22	739.0
Office Buildings	1,204	10.19	11.67	123.0
Schools and Colleges	2,117	8.84	4.79	187.0
Restaurants	906	8.83	11.18	80.0
Hotels and Motels	7,113	5.82	1.92	414.0
Laundries and Laundromats	3,290	3.95	1.38	130.0
Hospitals and Medical Offices	1,236	3.90	4.19	48.0
Food Stores	729	2.86	5.20	21.0
Auto Shops	687	1.97	6.74	14.0
Membership Organizations	629	1.95	5.60	12.0
Car Washes	3,031	0.82	0.36	25.0

Source: Modified from Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000
a – gpdc = gallons per day per customer
b – "Percent of CI customers" pertains to CI customers in agencies utilizing the particular subsector.
c – Scaled average daily use = average annual daily use in subsector x percent of total CI use attributed to the subsector.

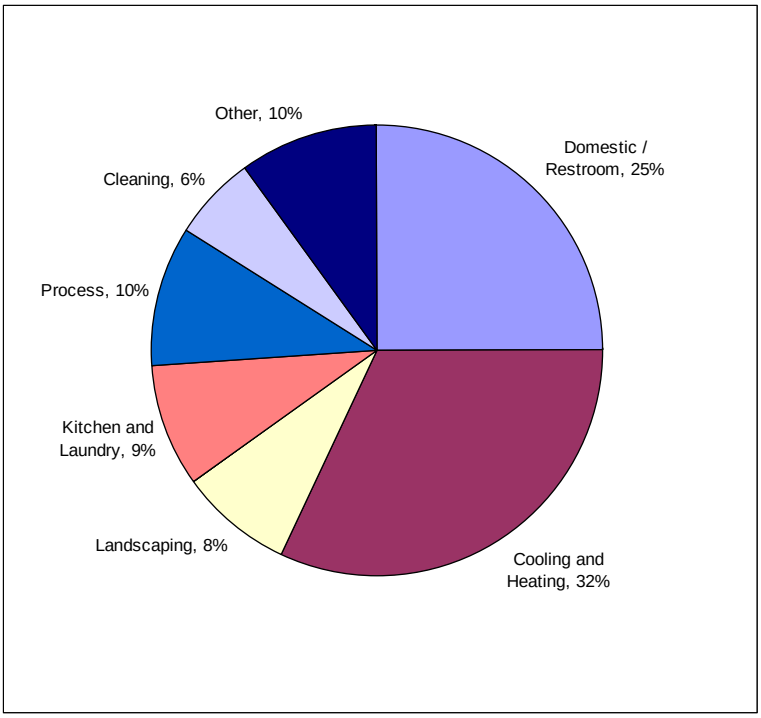
Appendix B:

Data on End Use Application of Water by Subsector

Due to the diverse range of subsectors within the CI sector, generalizing the end use of water can be difficult. By looking at end uses on a subsector level, however, there are a great number of patterns regarding end use that can be established. This appendix summarizes the best available data on the end uses of water on a CI subsector basis.

CI sector water use in Denver was broken out by end use in 1991 (see Figure B1). (11) The figure displays that domestic water use and cooling and heating are among the main water end uses in the CI sector.

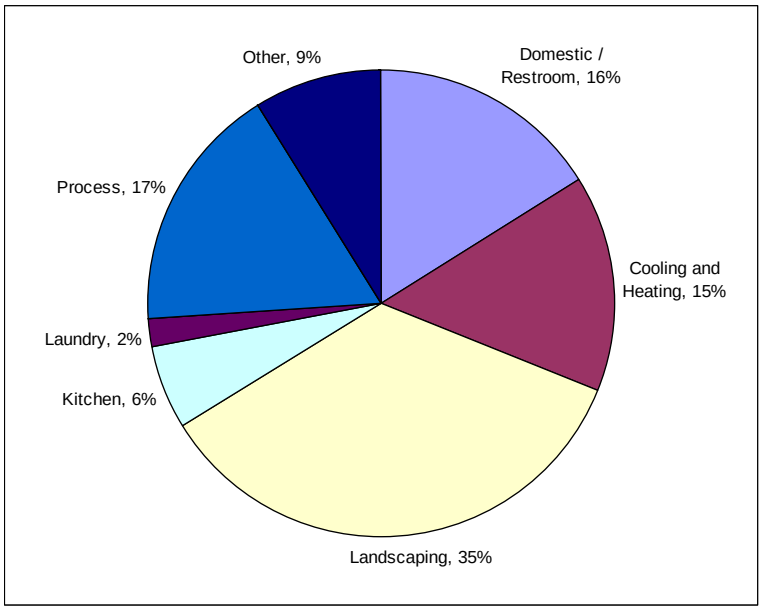
Figure B1. End Uses of Water in the CI Sector in Denver (1991)



Source: Modified from Sharon deMonsabert and Barry L. Liner, *WATERGY: A Water and Energy Conservation Model for Federal Facilities*, January 1996

Waste Not, Want Not characterized CI end uses in California, consolidated in Figure B2. In California, due to climate, water use for landscaping takes precedent over some other end uses. Water use for restrooms and cooling remain significant end uses. (4)

Figure B2. Estimated Water Use in the CII Sector by End Use in California in 2000



Source: Modified from Peter H. Gleick, et. al., *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003

These models characterize the end uses in the entire CI sector and begin to demonstrate that CI water use varies among geographic locations. In addition, the specific end uses of water in the CI sector vary depending on the nature of the business and the levels of technology and water use efficiency in different business establishments. End use water distribution in the CI subsectors described in Section II.B varies widely. Some potential end uses in CI subsectors include:

- Indoor/Domestic Water
  - Kitchens, cafeterias, staff rooms
    - Faucets
    - Distilled/drinking water
    - Dishwashing machines
    - Ice machines
    - Garbage disposals
    - Food preparation
    - Frozen yogurt and ice cream machines
  - Restrooms and showers
    - Faucets
    - Toilets and urinals
    - Showers
  - Laundry
    - Washing machine
  - Sanitation
    - Facility cleaning
    - Sterilizers/autoclaves
    - Equipment washing

        - Dust control
        - Container washing
    - Process
        - Photographic and x-ray processing
- Cooling and Heating
    - Cooling towers
    - Evaporative coolers
    - Boilers and steam systems
    - Once-through cooling
        - Air conditioners
        - Air compressors
        - Hydraulic equipment
        - Degreasers
        - Rectifiers
        - Vacuum pumps
- Outdoor Water Use
    - Irrigation
    - Pools and spas
    - Decorative water feature

Commercial and Institutional End Uses of Water presents information on the end water uses for several subsectors. Many unique variables apply to each subsector that can create a large degree of variability in terms of how much water is used in those facilities. (3) For example:

- Restaurants: number of meals served; seating capacity; operating hours; type of restaurant; type of kitchen operations; type of meals; etc.

- Hotels and motels: number of rooms; number of occupants; presence of restaurant, kitchen, laundry, swimming pool, and/or spa; type of icemakers; etc.

- Supermarkets: sales; number of aisles; number of public restrooms; mist sprayers on vegetables; hours of operation; presence of deli, meat shop, and/or photo finishing; etc.

- Schools: number of pupils; number of showers; cafeteria/kitchen equipment; hours occupied; number of sporting events; etc.

- Office buildings: number of employees; type of business; number of visitors; presence of eating establishment; type of cooling installation; hours occupied; etc.

While the available data lacks the specificity needed to benchmark CI facilities based on these variables, significant information regarding their typical end uses exist. Tables B1 through B6 present an allocation of end uses in hospitals, schools, hotels, commercial office buildings, commercial laundries, and restaurants, as reproduced from *Commercial and Institutional End Uses of Water* (3). This collection of data is based on measurements and estimates from water audits of six U.S. service areas.

Table B1. End Uses of Water in Hospitals (Percent of Total Hospital Use)

General Purpose	Specific Purpose	Phoenix	Denver	Mesa	Ventura	Los Angeles	Weighted Average [b]
Domestic	Plumbing [a]	24.33	39.7	22.95	37.87	18.65	27.05
	Kitchen	8.5	4.53	2.86	4.51	6.51	6.04
Cooling	Cooling tower	27.43	7.22	32.63	8.11	31.29	23.66
	Evaporative coolers	5.08	8.8	7.76	NA	NA	4.88
	Boilers	2.32	3.61	3.25	1.02	0.31	2.24
Process rinses	Photo processing	2.00	4.91	13.99	3.42	7.26	5.78
	Product water	NA	5.43	0.58	NA	10.85	3.12
Cleaning	Plant cleaning	NA	4.78	NA	NA	NA	0.89
Sanitation	Sterilizers/autoclaves	6.04	4.91	NA	16.95	4.65	5.42
	Ingredients cleaning	NA	NA	NA	0.31	NA	0.03
Laundry		7.68	12.33	NA	8.43	0.5	5.91
Water treatment		3.42	NA	2.4	6.48	16.18	5.22
Landscape		13.16	3.77	9.35	11.59	3.3	8.77
Miscellaneous		0.04	NA	4.22	1.30	0.50	0.97
Number of establishments		3	4	2	1	2	12
Average water use per establishment (gpd)[c]		314,640	160,550	154,000	73,330	159,320	172,390

Source: Dziegielewski, et. al., *Commercial and Institutional End Uses of Water*, 2000 (originally adapted from *Journal of AWWA*, vol. 84, no. 10 [October 1992], by permission, Copyright© 1992, American Water Works Association)
NA – Information not available
[a] – Plumbing includes lavatory faucets, toilets, urinals, and showerheads.
[b] – The average is weighted by the proportion of each service area in the combined total use of this category.
[c] – Gallons per day.

Table B2. End Uses of Water in Schools (Percent of Total School Use)

General Purpose	Specific Purpose	Phoenix	Denver	Weighted Average [b]
Domestic	Plumbing [a]	33.14	47.79	43.47
	Kitchen	6.27	5.35	5.32
Cooling	Cooling tower	1.51	5.21	4.13
	Evaporative coolers	0.16	NA	0.05
	Boilers	0.80	NA	0.24
Process rinses	Photo processing	2.09	5.30	4.35
Sanitation	Ingredients cleaning	NA	2.93	2.07
Laundry		1.92	3.88	3.30
Landscape		54.11	29.54	36.77
Number of establishments		4	5	9
Average water use per establishment (gpd)[c]		36,390	87,110	61,770

Source: *Commercial and Institutional End Uses of Water*, Dziegielewski, et. al., 2000 (originally adapted from *Journal of AWWA*, vol. 84, no. 10 [October 1992], by permission, Copyright© 1992, American Water Works Association)
NA – Information not available
[a] – Plumbing includes lavatory faucets, toilets, urinals, and showerheads.
[b] – The average is weighted by the proportion of each service area in the combined total use of this category.
[c] – Gallons per day.

Table B3. End Uses of Water in Hotels (Percent of Total Hotel Use)

General Purpose	Specific Purpose	Phoenix	Denver	Ventura	Weighted Average [b]
Domestic	Plumbing [a]	17.08	30.62	33.72	23.97
	Kitchen	18.31	9.96	NA	13.26
Cooling	Cooling tower	0.64	18.43	NA	7.49
	Evaporative coolers	0.25	NA	NA	0.13
Process rinses	Product water	NA	6.41	3.62	2.85
Sanitation	Ingredients cleaning	4.67	17.25	29.76	12.03
Laundry		16.82	3.10	22.65	12.07
Water treatment		0.71	NA	NA	0.37
Landscape		41.32	NA	10.25	22.2
Miscellaneous		0.20	14.25	NA	5.63
Number of establishments		4	2	1	7
Average water use per establishment (gpd)[c]		202,140	153,070	38,940	131,390

Source: *Commercial and Institutional End Uses of Water*, Dziegielewski, et. al., 2000 (originally adapted from *Journal of AWWA*, vol. 84, no. 10 [October 1992], by permission, Copyright© 1992, American Water Works Association)
NA – Information not available
[a] – Plumbing includes lavatory faucets, toilets, urinals, and showerheads.
[b] – The average is weighted by the proportion of each service area in the combined total use of this category.
[c] – Gallons per day.

Table B4. End Uses of Water in Office Buildings (Percent of Total Office Building Use)

General Purpose	Specific Purpose	Phoenix	Denver	Weighted Average [b]
Domestic	Plumbing [a]	22.35	40.39	37.21
	Kitchen	1.54	NA	0.27
Cooling	Cooling tower	56.05	20.97	27.15
	Evaporative coolers	1.77	1.61	1.64
	Boilers	0.68	5.24	4.44
Process rinses	Photo processing	0.25	0	0.04
	Product water	NA	0.10	0.08
Sanitation	Cleaning ingredients, containers	0.23	NA	0.04
Laundry		1.54	NA	0.27
Water treatment		4.13	NA	0.73
Landscape		12.87	21.60	20.06
Miscellaneous		0.13	NA	0.02
Number of establishments		13	3	16
Average water use per establishment (gpd)[c]		55,930	261,850	139,150

Source: *Commercial and Institutional End Uses of Water*, Dziegielewski, et. al., 2000 (originally adapted from *Journal of AWWA*, vol. 84, no. 10 [October 1992], by permission, Copyright© 1992, American Water Works Association)
NA – Information not available
[a] – Plumbing includes lavatory faucets, toilets, urinals, and showerheads.
[b] – The average is weighted by the proportion of each service area in the combined total use of this category.
[c] – Gallons per day.

Table B5. End Uses of Water in Commercial Laundries (Percent of Total Commercial Laundry Use)

General Purpose	Specific Purpose	Phoenix	Denver	Weighted Average [b]
Domestic	Plumbing [a]	2.49	3.53	2.92
Cooling	Cooling tower	6.42	0.31	3.95
	Evaporative coolers	1.97	1.58	1.81
Process rinses	Product water	NA	0.31	0.19
Sanitation	Ingredients cleaning	80.73	89.78	84.38
Water treatment		8.26	NA	4.91
Miscellaneous		0.13	4.34	1.84
Number of establishments		13	3	16
Average water use per establishment (gpd)[c]		76,300	51,850	64,090

Source: *Commercial and Institutional End Uses of Water*, Dziegielewski, et. al., 2000 (originally adapted from *Journal of AWWA*, vol. 84, no. 10 [October 1992], by permission, Copyright© 1992, American Water Works Association)
NA – Information not available
[a] – Plumbing includes lavatory faucets, toilets, urinals, and showerheads.
[b] – The average is weighted by the proportion of each service area in the combined total use of this category.
[c] – Gallons per day.

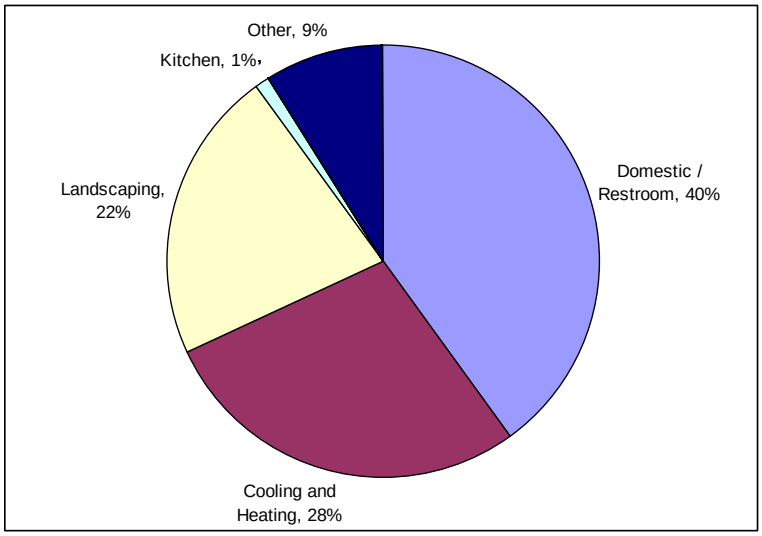
Table B6. End Uses of Water in Restaurants (Percent of Total Restaurant Use)

General Purpose	Specific Purpose	Denver	Tri-county FL [d]	Weighted Average [e]
Domestic	Plumbing [a]	27.75	35.33	31.05
	Kitchen	48.48	50.00	49.14
Cooling	Cooling tower	0.10	0	0.06
	Evaporative coolers	3.20	0	1.81
Sanitation	Ingredients cleaning	4.40	0.22 [b]	2.58
Laundry		0.70	0	0.40
Landscape		4.30	2.45	3.49
Other		2.30	12.03 [c]	6.54
Unaccounted		8.70	0	4.91
Number of establishments		3	6	9
Average water use per establishment (gpd)[f]		7,524	5,800	6,773

Source: *Commercial and Institutional End Uses of Water*, Dziegielewski, et. al., 2000 (originally adapted from *Journal of AWWA*, vol. 84, no. 10 [October 1992], by permission, Copyright© 1992, American Water Works Association)
NA – Information not available
[a] – Plumbing includes lavatory faucets, toilets, urinals, and showerheads.
[b] – Also included laundry.
[c] – Also included unaccounted use.
[d] – Tri-County area includes Hillsborough County, Pasco County, and Pinellas County.
[e] – The average is weighted by the proportion of each service area in the combined total use of this category.
[f] – Gallons per day.

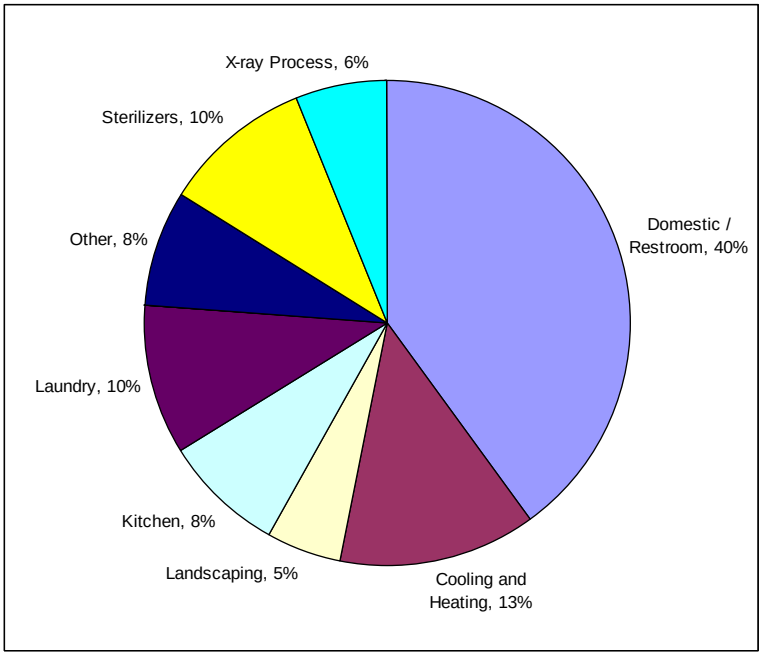
In *A Water Conservation Guide for Commercial, Institutional, and Industrial Water Users* prepared by the New Mexico Office of the State Engineer in July 1999, water usage estimates were developed for several CI subsectors as displayed in Figures B3 through B6. (6)

Figure B3. Water Usage in Office Buildings



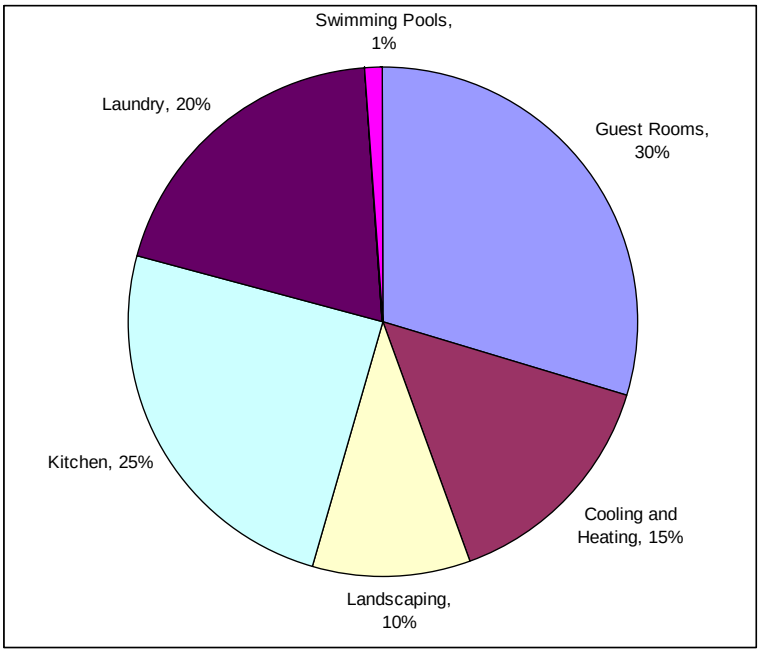
Source: Modified from New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department)

Figure B4. Water Usage at Hospitals



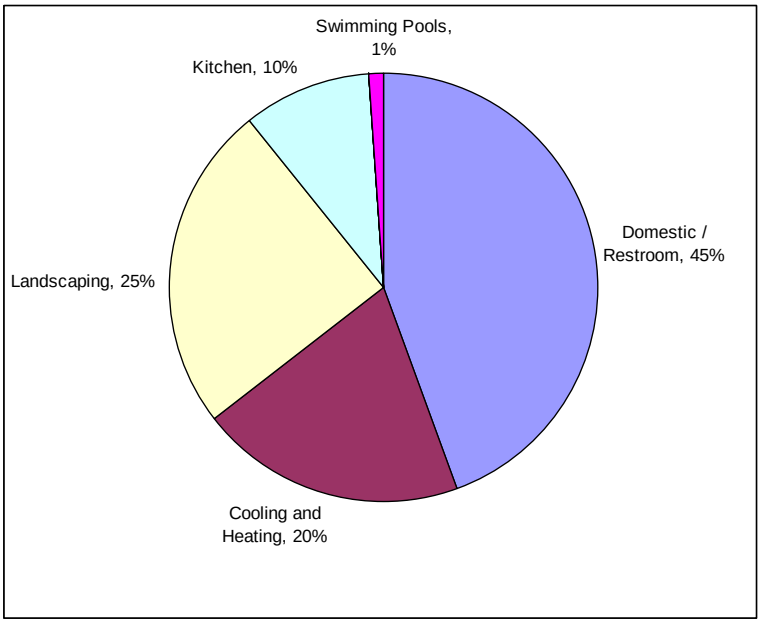
Source: Modified from New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department)

Figure B5. Water Usage at Hotels and Motels



Source: Modified from New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department)

Figure B6. Water Usage at Schools



Source: Modified from New Mexico Office of the State Engineer, *Water Conservation Guide for Commercial, Institutional, and Industrial Water Users*, July 1999 (original source: City of San Jose Environmental Services Department)

These figures further illustrate that end use varies by subsector—in type and distribution.

Because water use is so variable among the CI subsectors, it is difficult, or nearly impossible, to compare facilities from one subsector to another. Water use must be normalized per some unit—number of customers, number of employees, total output, facility area, number of seats/chairs, or other units. Even using normalized data, it is not reasonable to compare some subsectors that have different purposes and end uses to one another.