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## Chicago Green Office Challenge

### Water and Sewer Reduction

One portion of the Chicago Green Office Challenge is water conservation. Conserving water benefits the building owner, the city, and also conserves energy and chemicals used for water treatment and distribution. This handout provides some background information on what is involved in conducting a water audit and provides an example of a simple water saving calculation.

Developing a game plan for conservation

1. Data gathering
  - a. Gather at least one year's worth of water consumption data (or more)
  - b. Perform a fixture count and determine present consumption rates
    - i. Toilets/Urinals/Lavatories/showers
    - ii. Kitchens: sinks/dishwashers/spray valves
  - c. Identify mechanical equipment that use water
    - i. Cooling towers
    - ii. Boilers
    - iii. Once-through cooling equipment
  - d. Other
    - i. Landscaping
    - ii. Mopsinks/maintenance/cleaning
2. Identify opportunities
  - a. Domestic consumption opportunities
    - i. Toilets/urinals/sink aerators
    - ii. Kitchen improvements
  - b. Mechanical improvements
    - i. Eliminate once-through cooling systems
    - ii. Automate blowdown in cooling towers and boilers
  - c. Other
    - i. Xeriscape
    - ii. Occupant behavior modification/education
3. Analysis
  - a. Examine consumption trends (spreadsheet analysis)
    - i. Determine baseline
    - ii. Summer increase? Landscaping/once through cooling
  - b. Uses spreadsheet to estimate
    - i. Quantity of usage for domestic use/mechanical/landscaping/etc.
    - ii. Potential savings for domestic use/mechanical/landscaping/etc.
    - iii. Calculate cost savings
  - c. Obtain cost estimates for retrofits
  - d. Calculate life cycle cost for each retrofit
  - e. Prioritize projects
4. Implementation
5. Follow-up data collection and analysis to determine success of projects

Some water conservation retrofits will save both electrical and thermal energy. Electrical energy is primarily saved by the city due to not having to process and pump as much water through its infrastructure and perform wastewater treatment functions. Building owners may also save electrical

energy if less water is pumped up to holding tanks in tall buildings and then gravity fed to lower floors. Additionally, natural gas or electrical energy can be saved with the reduction in use of heated water. Including energy savings in the economic analysis helps improve life cycle costs.

The following table illustrates a simplified calculation of a toilet, urinal, and lavatory retrofit for a office building.

Office building occupants	1,000	Lavatory usage/day	8
Female building occupants	500	Lavatory duration (sec)	15
Male building occupants	500	Annual days (5 days/wk x 50 wks)	250
Existing toilets (GPF*)	1.6	Existing water usage (gallons)	2,625,000
New toilets (GPF)	1.28	New water usage	1,346,875
Existing urinals (GPF)	1	Annual water savings	1,278,125
New urinals (GPF)	0.125	Water & sewer costs/1000 gallons	\$3.26
Existing lavatories (GPM*)	2.5		
New lavatories (GPM)	1	Existing water cost (\$)	\$8,558
Female toilet usage/day	4	New water cost (\$)	\$4,391
Male toilet usage/day	1	<b>Annual savings (\$)</b>	<b>\$4,167</b>
Male urinal usage/day	3		

\*GPF – Gallons per Flush  
\*GPM – Gallons per Minute

The savings calculations do not account for energy savings due to reduced hot water usage at the lavatory. Life cycle cost calculations would use the savings calculated above, anticipated projects costs, and the discount rate to determine internal rate of return or the net present value for the project. Businesses should compare the rates of return of different projects to select which projects to pursue in order to generate maximum return on investment.

Older buildings with original plumbing fixtures offer great savings potential. Pre 1994 toilets use 3.4 gallons or more per flush. In 1992, the Energy Policy Act mandated that the flush-toilet use only 1.6 gallons of water per flush and currently high efficiency toilets (HETs) have a flush volume of 1.28 gallons or less (look for the WaterSense rating). Likewise, newer ultra low-flow urinals only use a pint of water per flush compared to the standard 1.0 GPF. Also available are waterless urinals, but they can be problematic due to maintenance issues, especially in older buildings where the pipes may not be sloped enough.

Not to be forgotten are building mechanical systems that consume water. In particular, water cooled cooling towers can consume large quantities of water. Operation of these systems should be carefully examined.

Finally, landscaping can consume large quantities of water and typically offer large savings potential.

#### City of Chicago water and sewer rates

Effective Date	% Increase from prior yr	Water per 1,000 Gallons	Sewer as a % of Water Bill	Sewer per 1,000 Gallons	Water & Sewer per 1,000 Gallons
1/1/09	15%	\$1.76	85%	\$1.50	\$3.26
1/1/10	14%	\$2.01	86%	\$1.73	\$3.74

