

# This presentation premiered at WaterSmart Innovations

[watersmartinnovations.com](http://watersmartinnovations.com)



# Have We Just Harvested the Low Hanging Fruit?

***If so, Where Do We Go From Here?***

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# What Will Be Covered

- **A review of the past** — *Grass roots, Code, Government, The ethic, etc.*
- **Where has it gotten us to?**
- **So is what we are doing working?**
- **Where are the holes and opportunities?**
- **What the future can hold.**

# *The Early Days*

- Before pumps, homes were water efficient by necessity - *bucket and well*
- By the early - mid 1900's, conservation meant *dam it!*
- Agricultural water conservation hit the press first.
- By the 1970's a new ethos was developing.

# Where We Stand Today

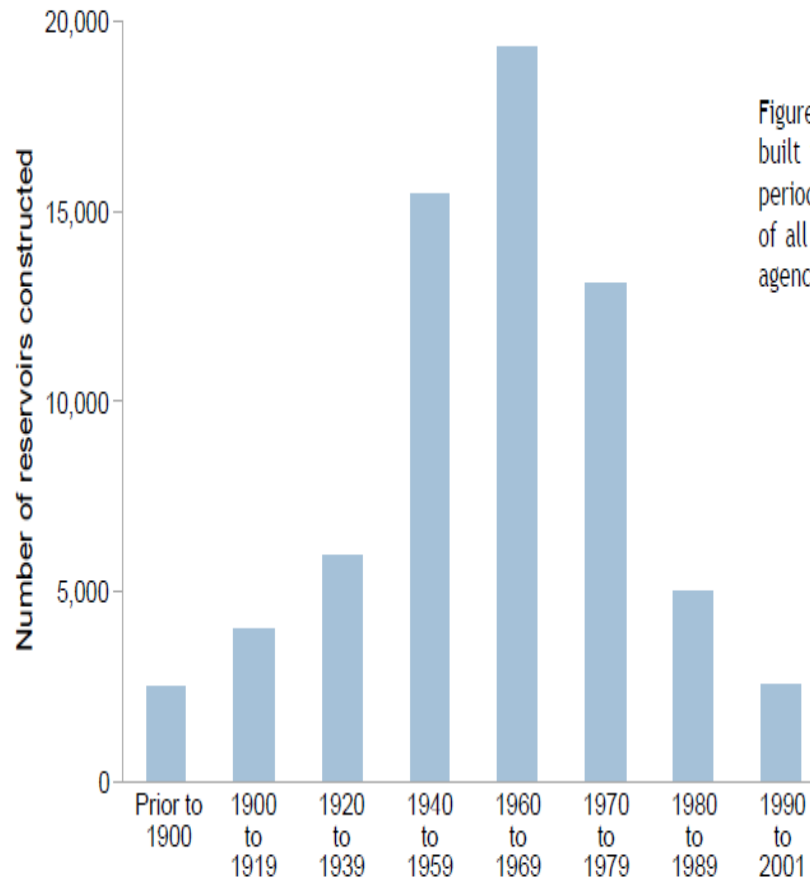
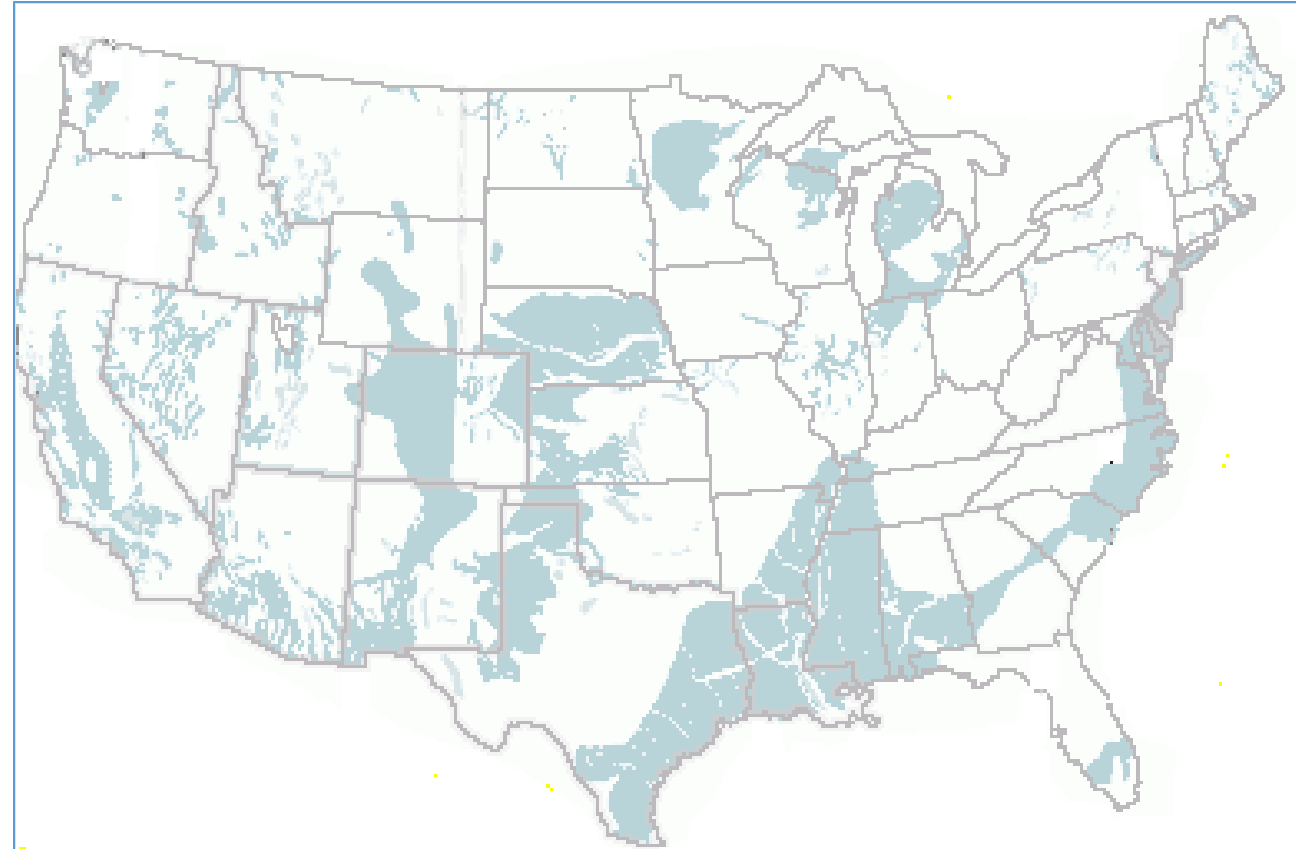


Figure 3.1. The number of reservoirs built in the United States by time period. This figure includes dams of all sizes recorded by regulatory agencies (Gleick, 2000).

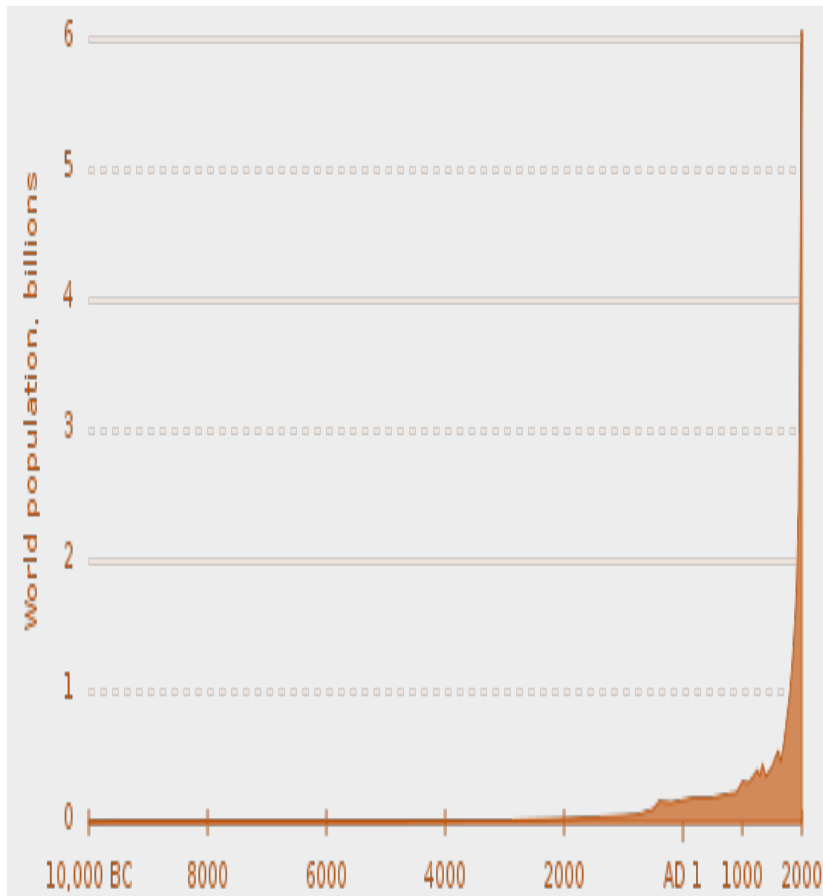


Areas where subsidence has been attributed to groundwater pumpage (Land Subsidence in the United States, USGS Circular 1182)

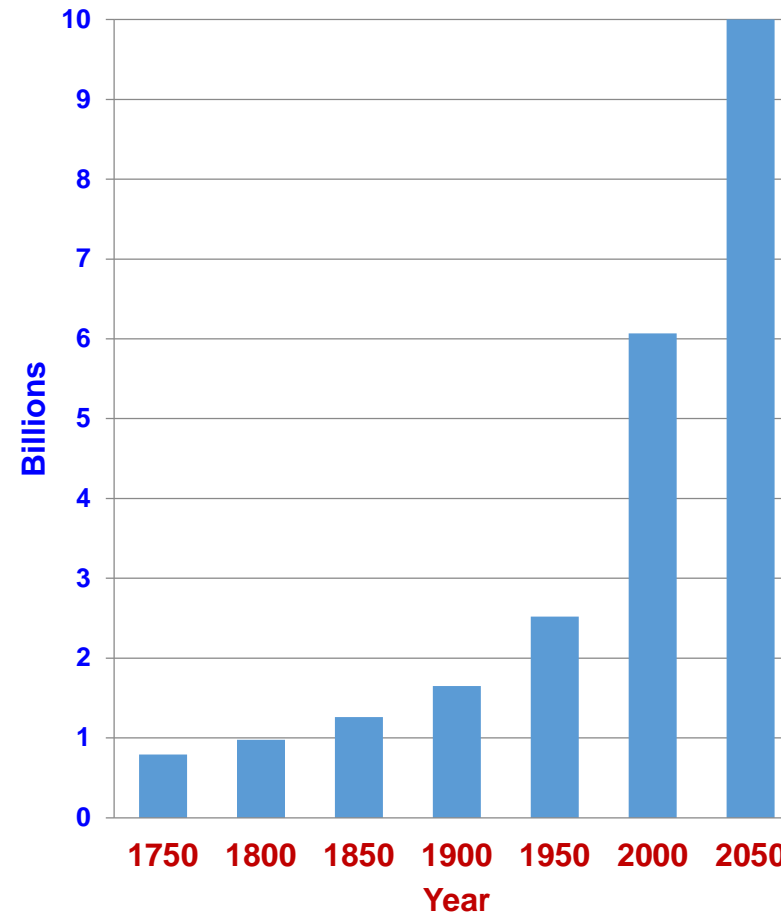
# World Population

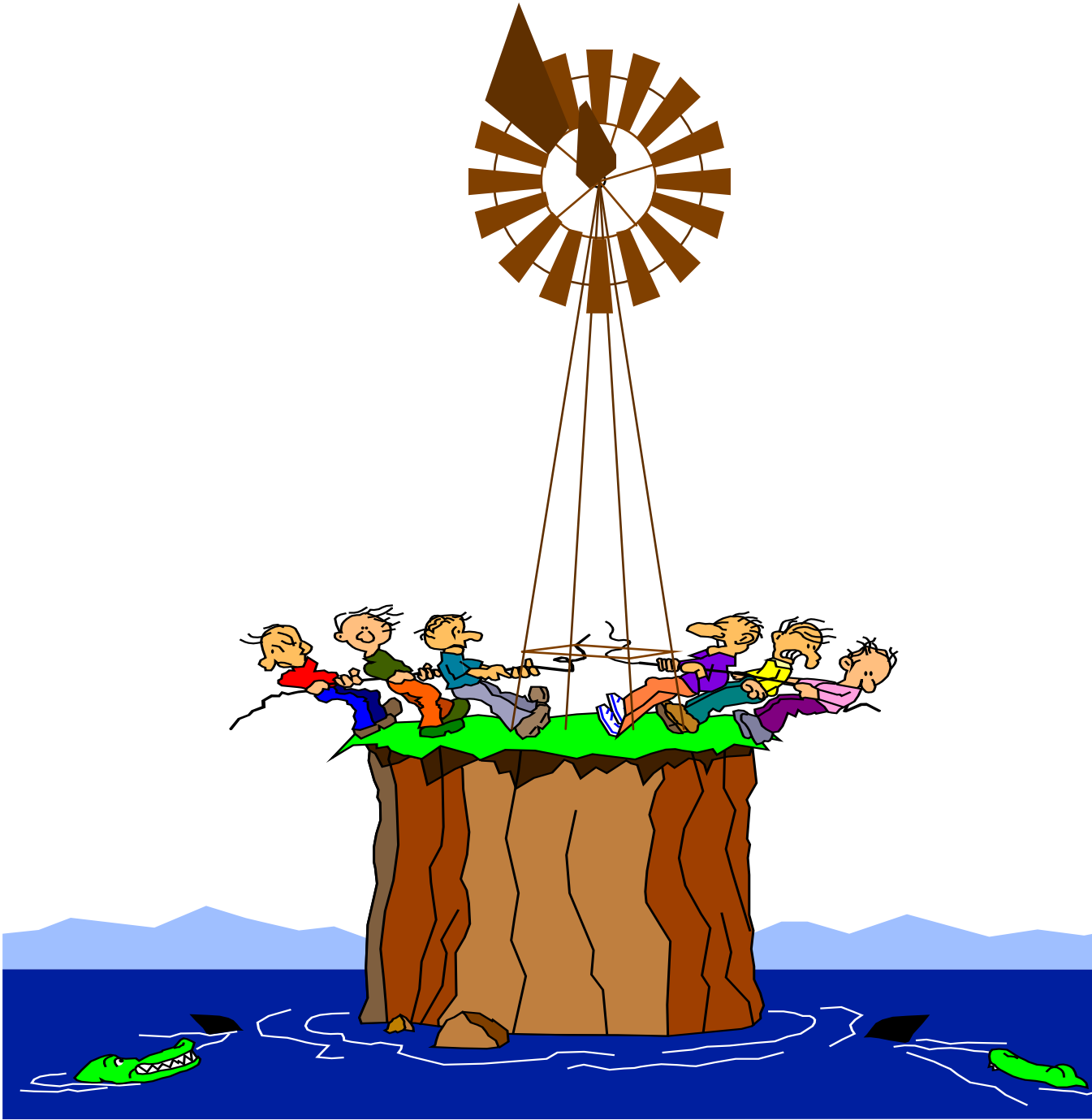
## *And All Need Water!*

Population over Human History



World Population since 1750





You can  
only get as  
much as  
mother  
nature  
allows you  
to. Any  
more &  
????

## 1970's The Wake Up!

- ❖ The beginning of State efforts
- ❖ New York, Arizona, Florida, Texas, & California begin efforts
- ❖ The Federal Government begins to take notice.

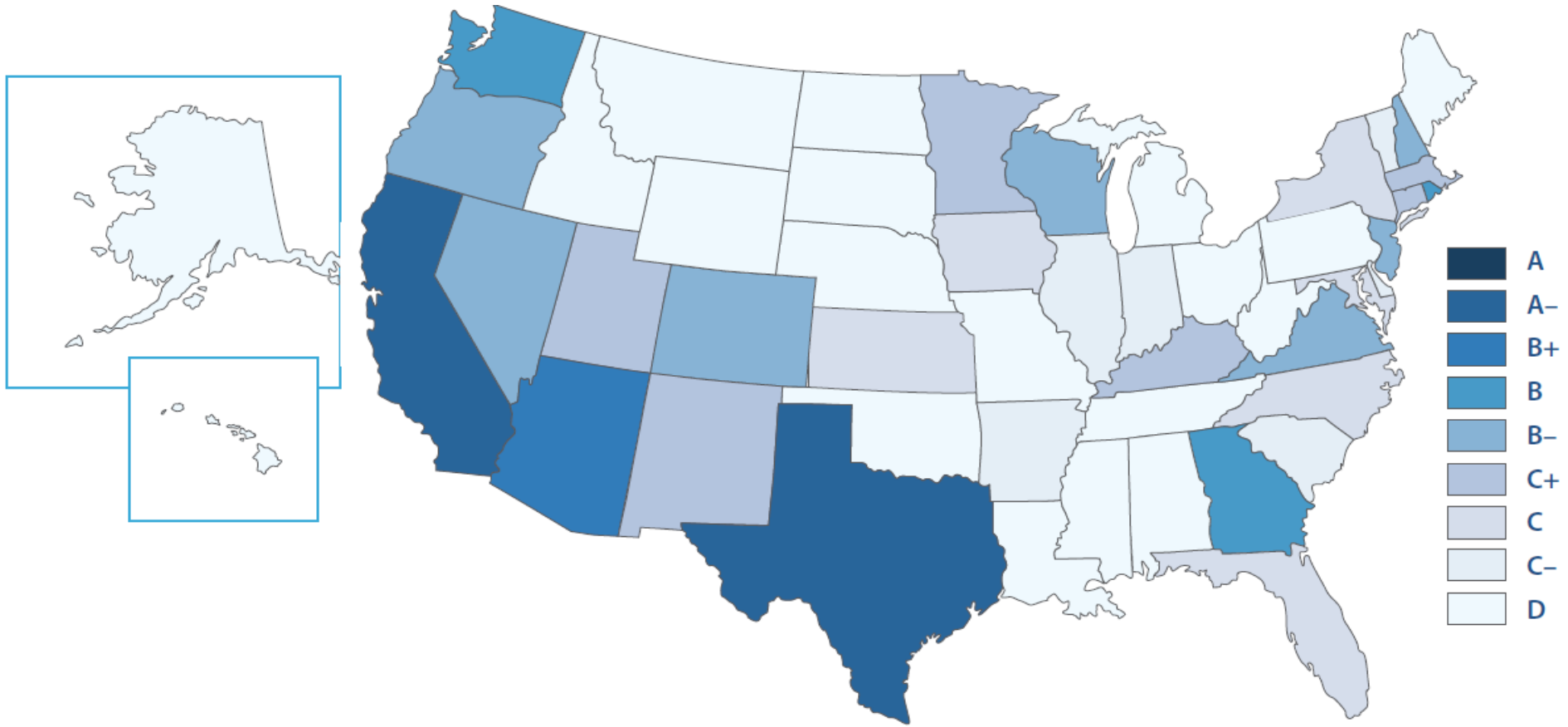
## 1980's The Start

- ❖ First national conferences, xeriscape, WaterFolies
- ❖ State laws in California, Texas, Florida, Arizona, etc.
- ❖ AWWA after some delay gets involved
- ❖ Many good utility efforts have their shaky beginnings
- ❖ The learning curve starts



Flash Forward

# AWE State Score Card

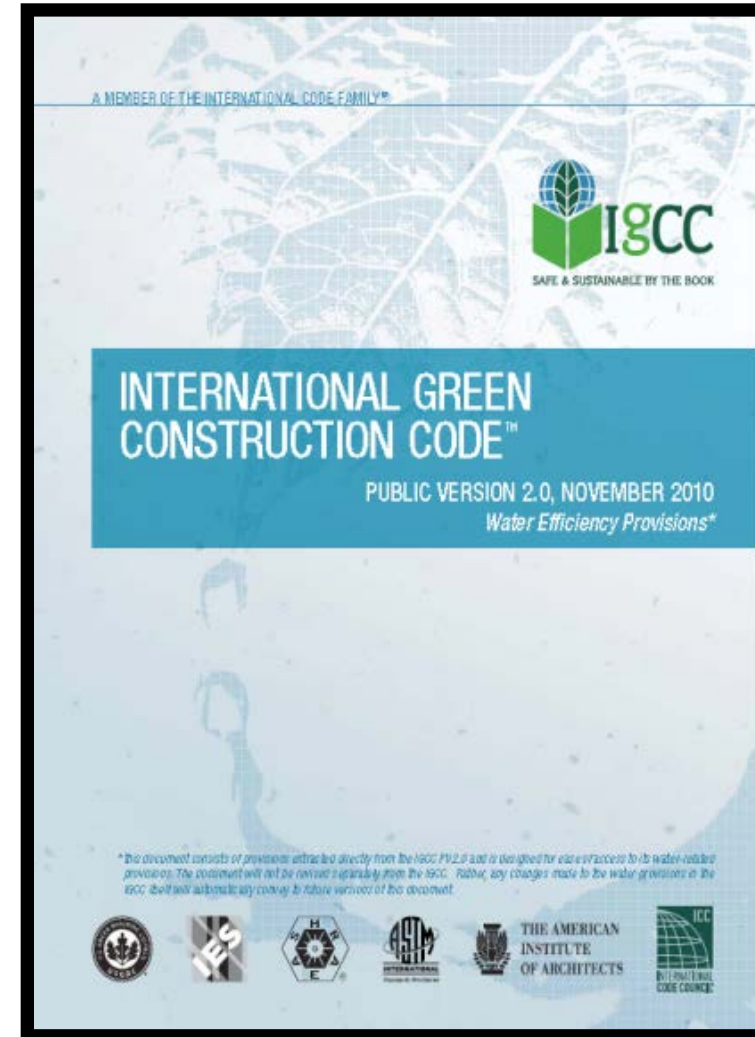
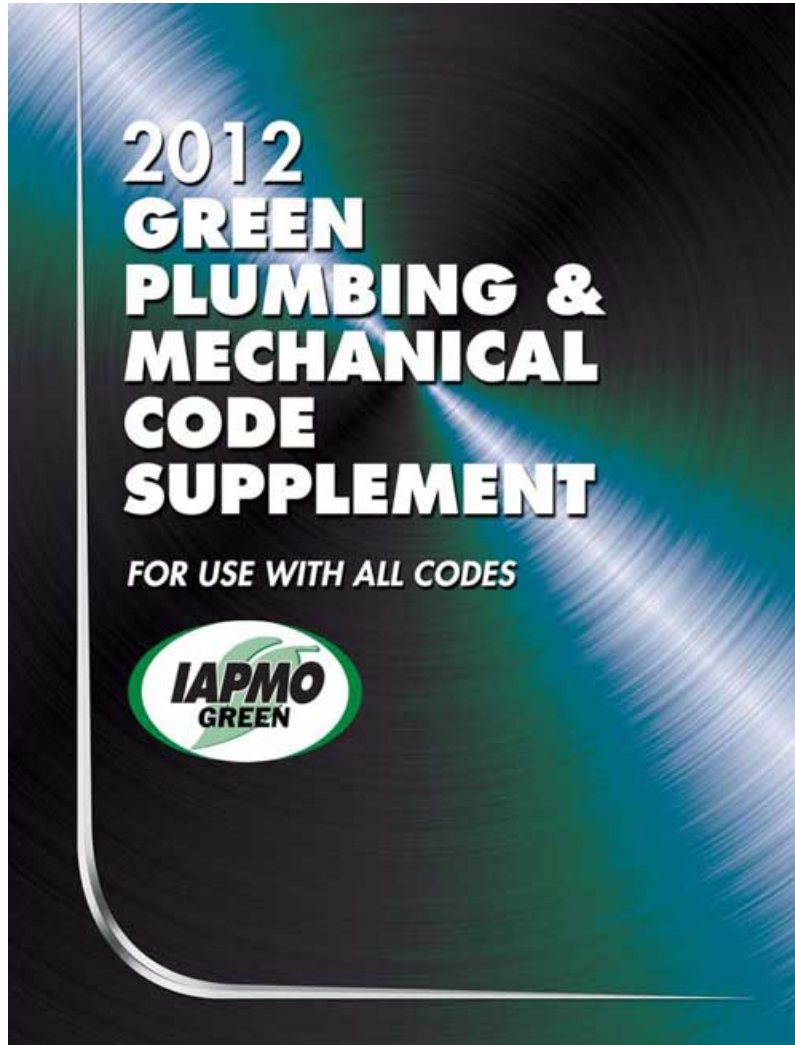


# Going Green is the “In Thing” According to Charlie Brown





# Examples of Codes



# Reduction in Water Use Since 1980



# LEED Water 2014

- Metering
- Landscape
- Fixtures & fittings
- Cooling towers
- Medical equipment
- Appliances & equipment
- Wastewater

# EPA EnergyStar<sup>®</sup> & *WaterSense*<sup>®</sup>

## EnergyStar<sup>®</sup>

- Residential & Commercial Dishwashers
- Residential & Commercial Clothes washers
- Commercial kitchen equipment

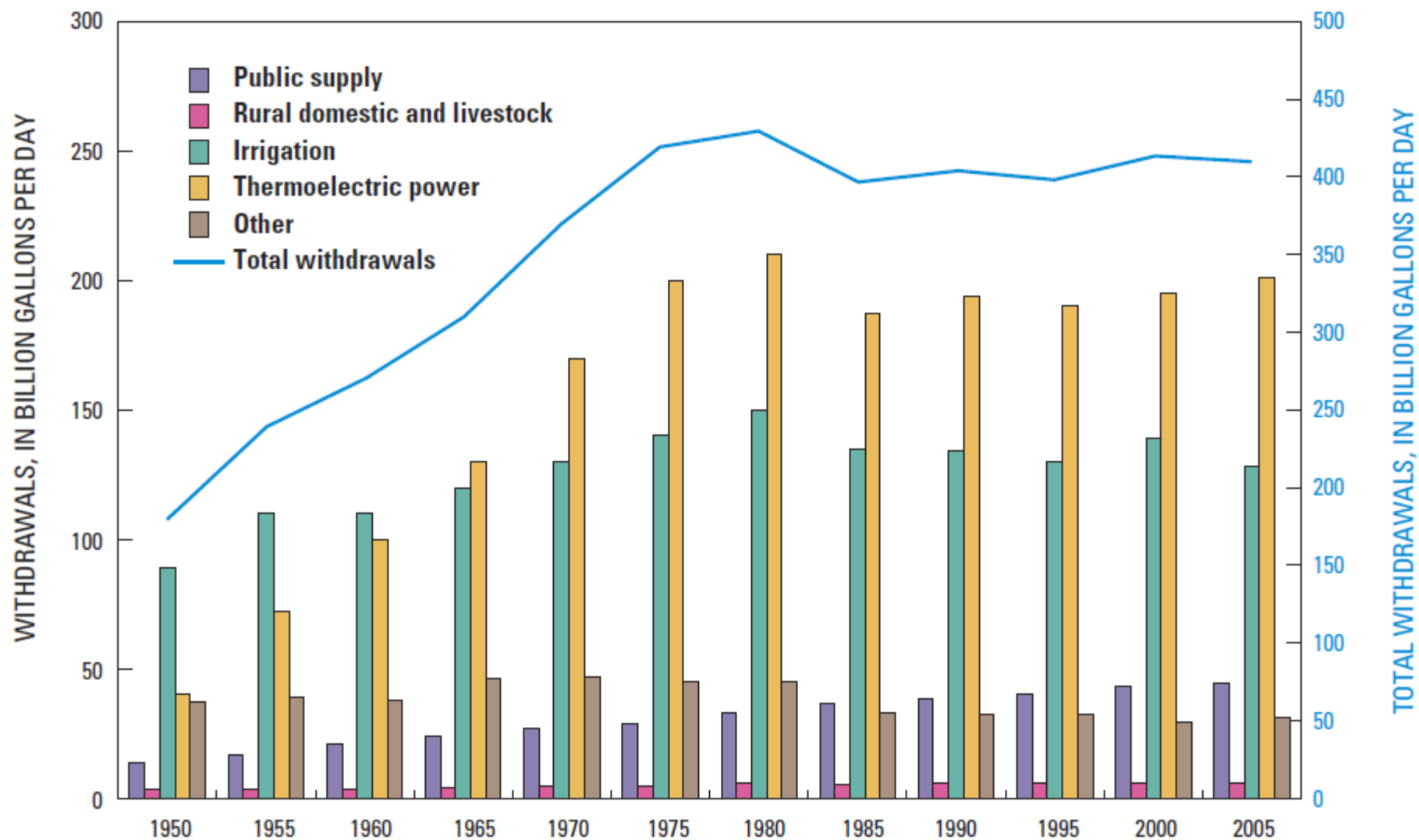
## WaterSense<sup>®</sup>

- Toilets & Urinals
- Faucets & Showers
- Pre-rinse Spray Valves
- Irrigation Controllers
- MUCH MP

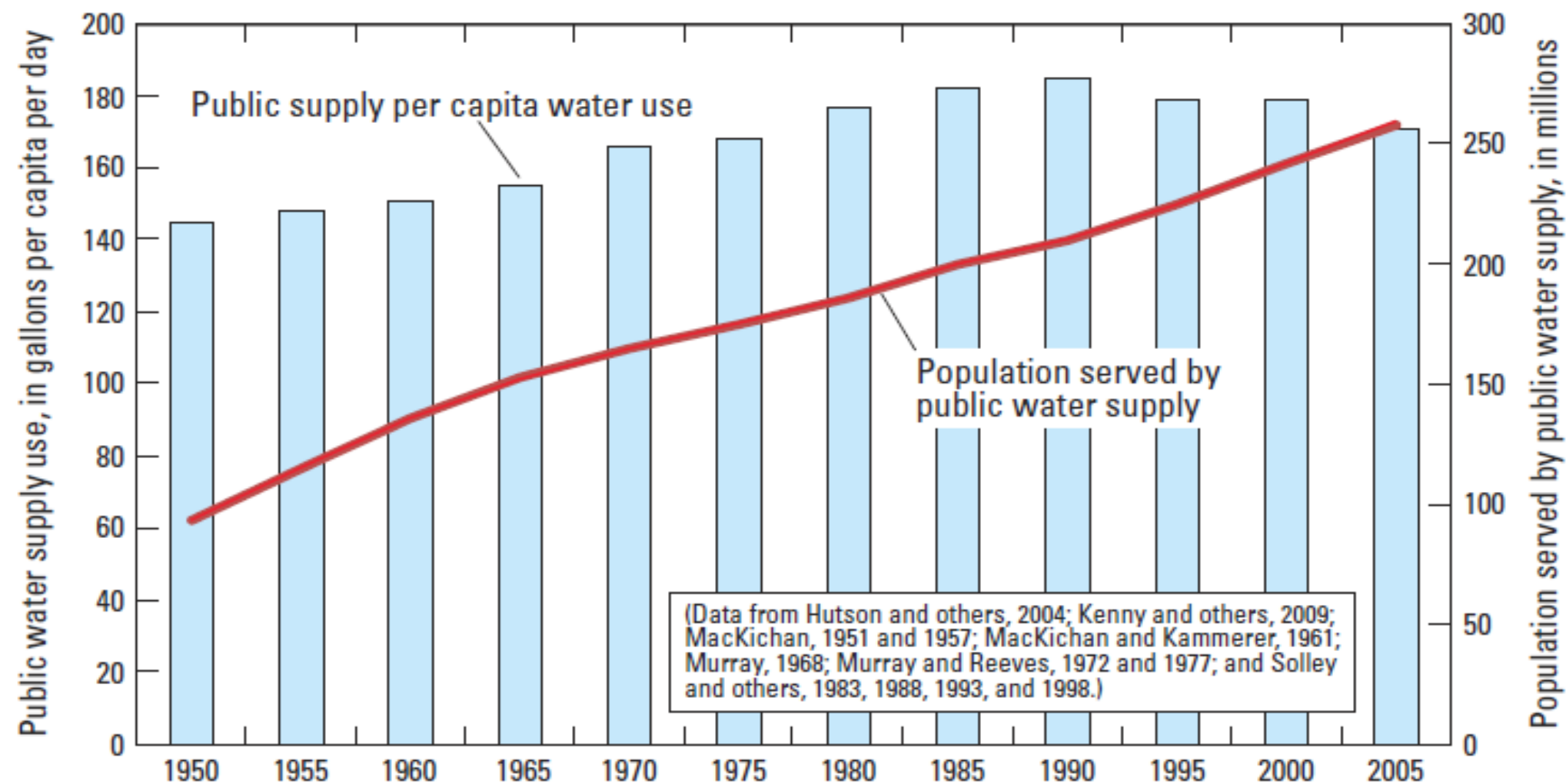
**The bottom line is that a  
lot of great people are  
doing a lot of great things!**



**So is it  
working?**

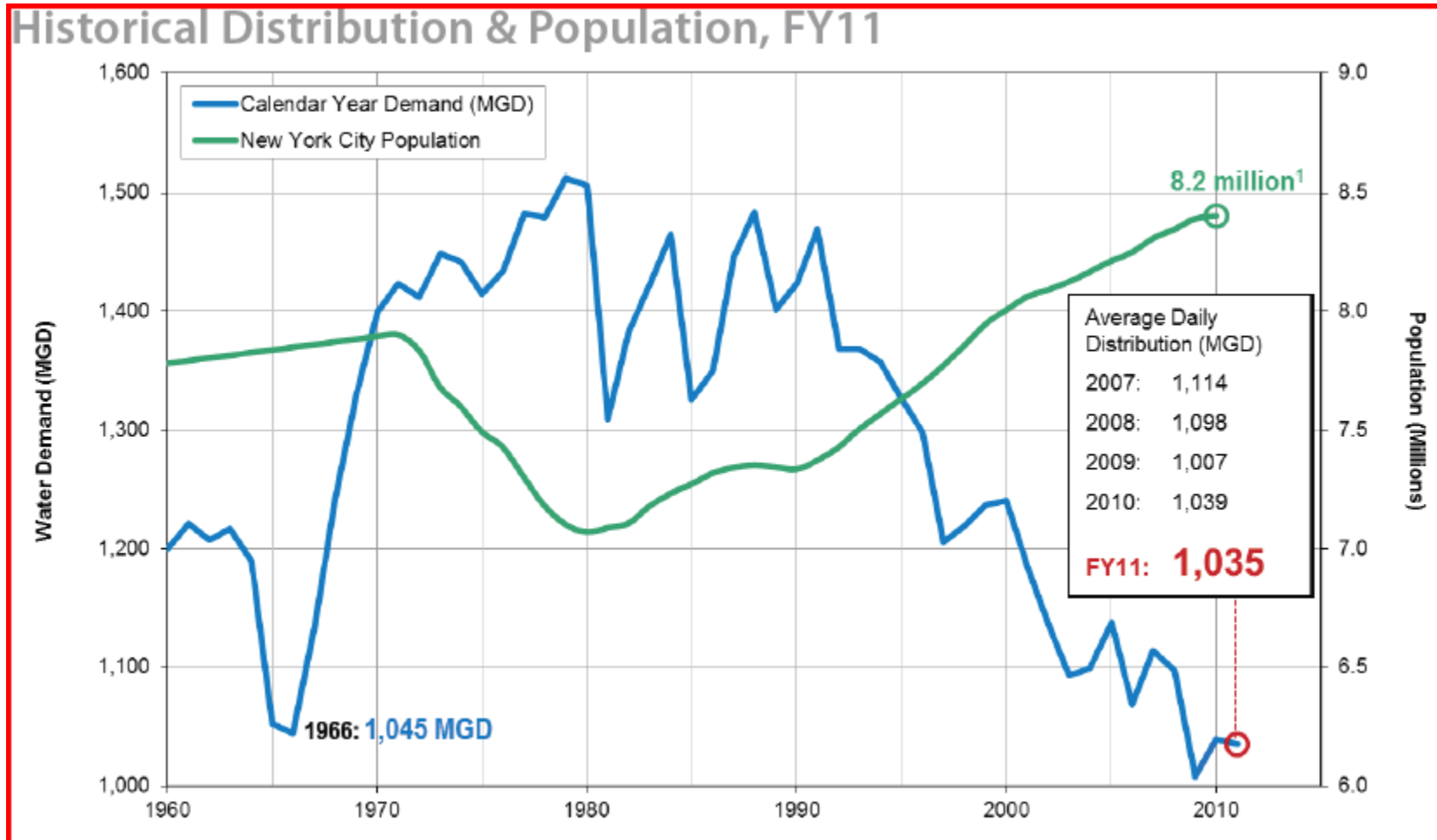


**Figure 14.** Trends in total water withdrawals by water-use category, 1950–2005.

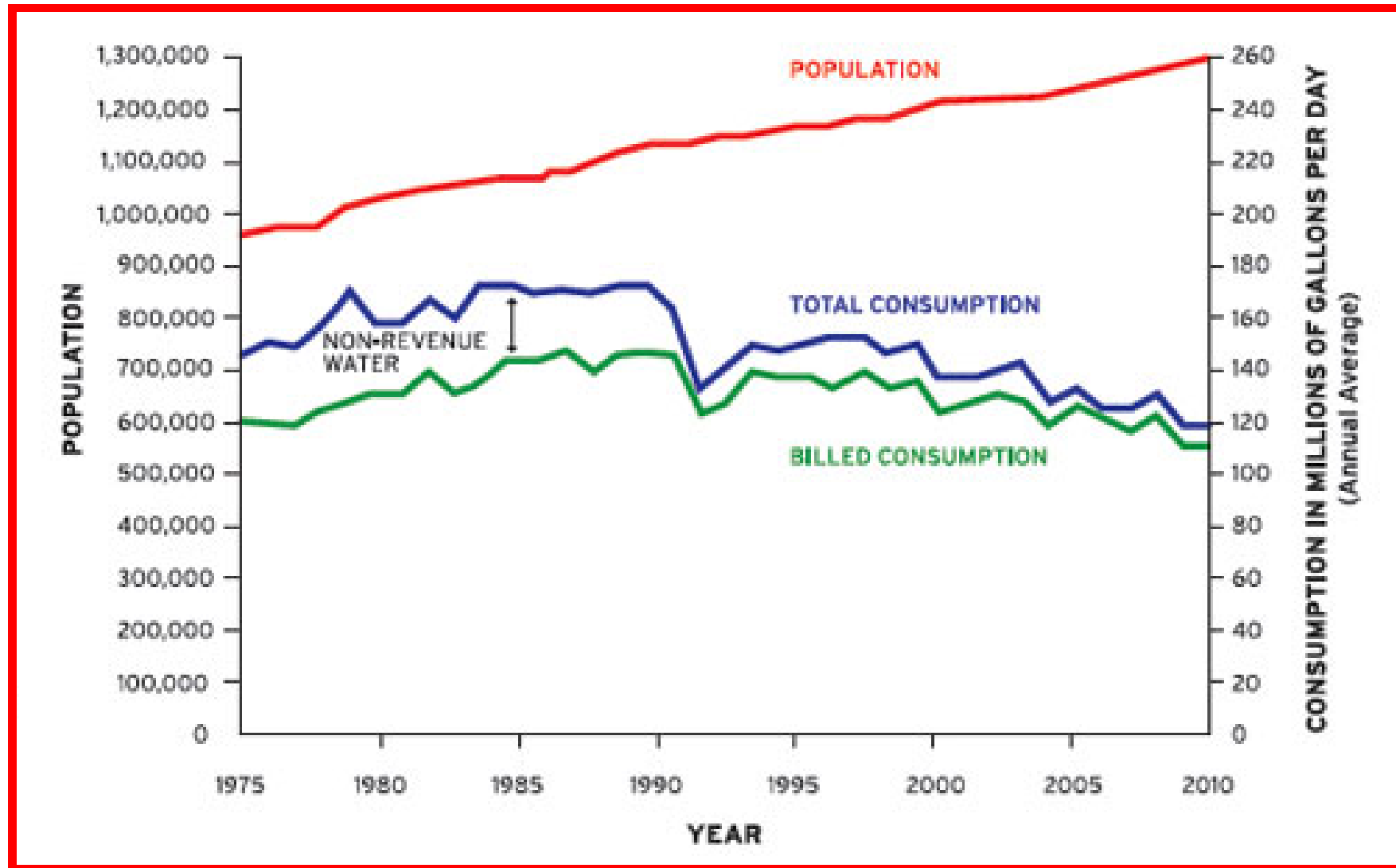


**Figure 12.** Public supply per capita water use and population served, United States, 1950–2005.

# New York City

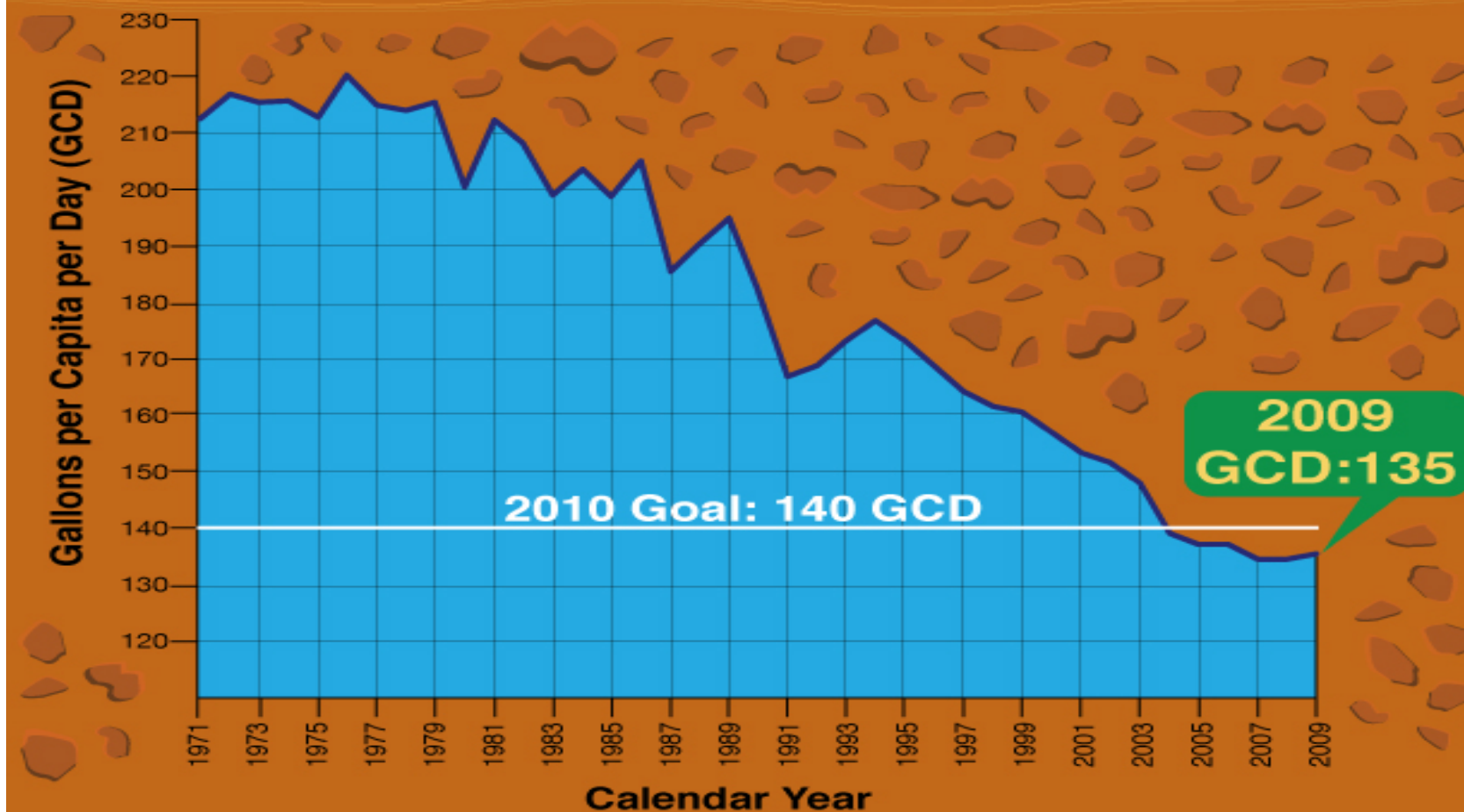


# Seattle Washington



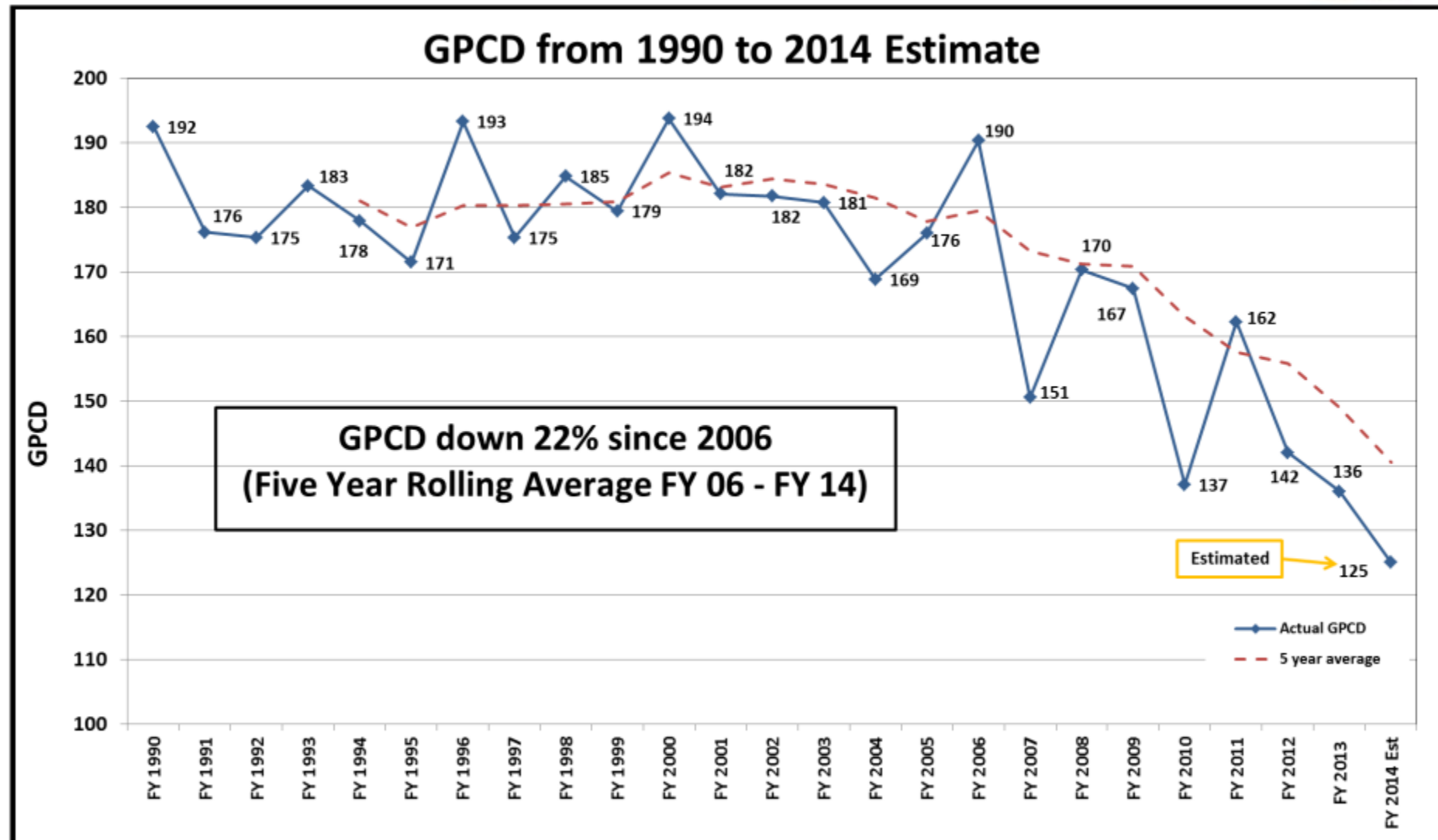
# El Paso Water Consumption

grist

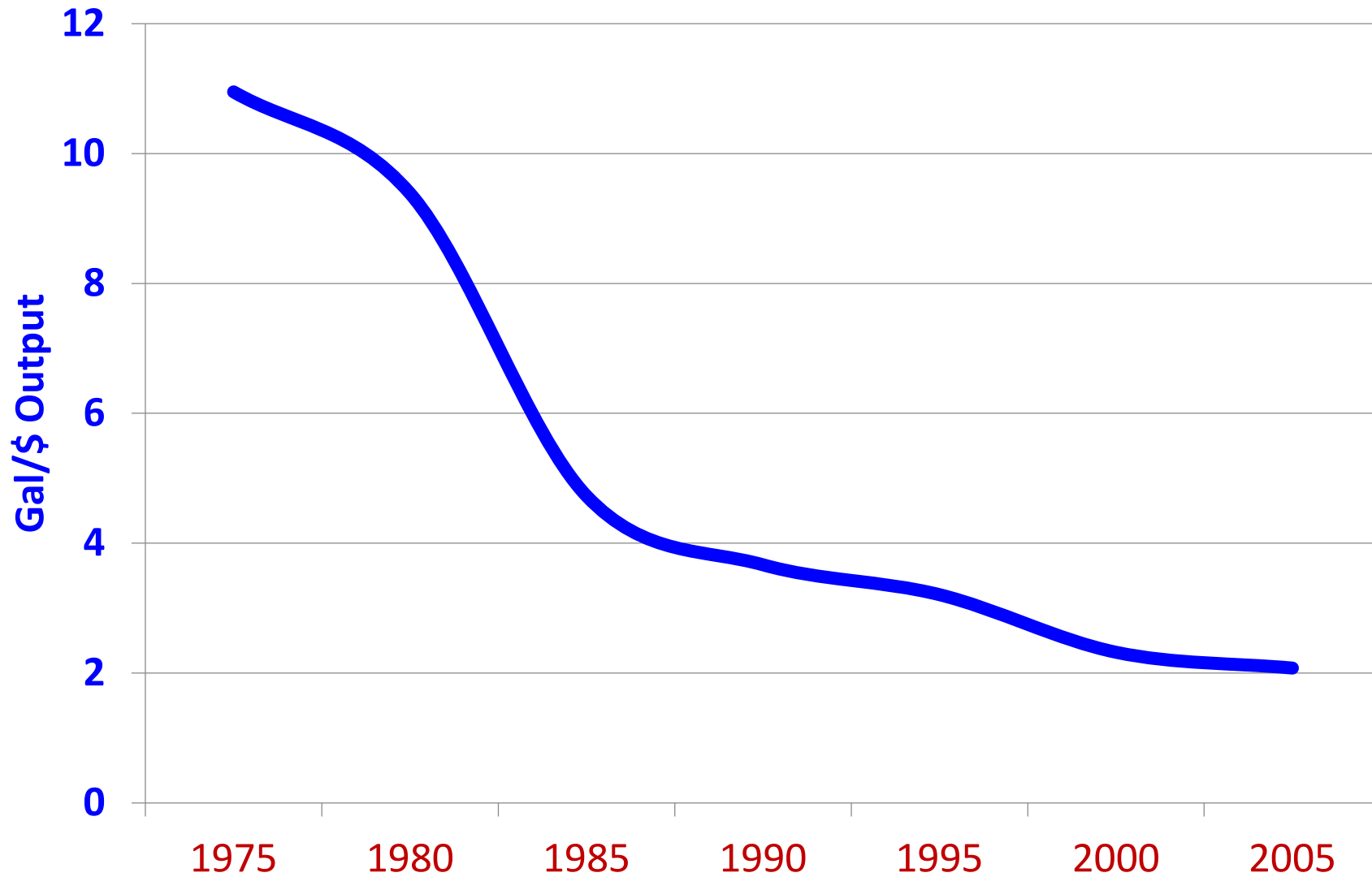


\*Data courtesy of El Paso Water Utilities

# GPCD from 1990 to 2014



## Gallons Used per Dollar (2005) of Manufacturing Output in USA

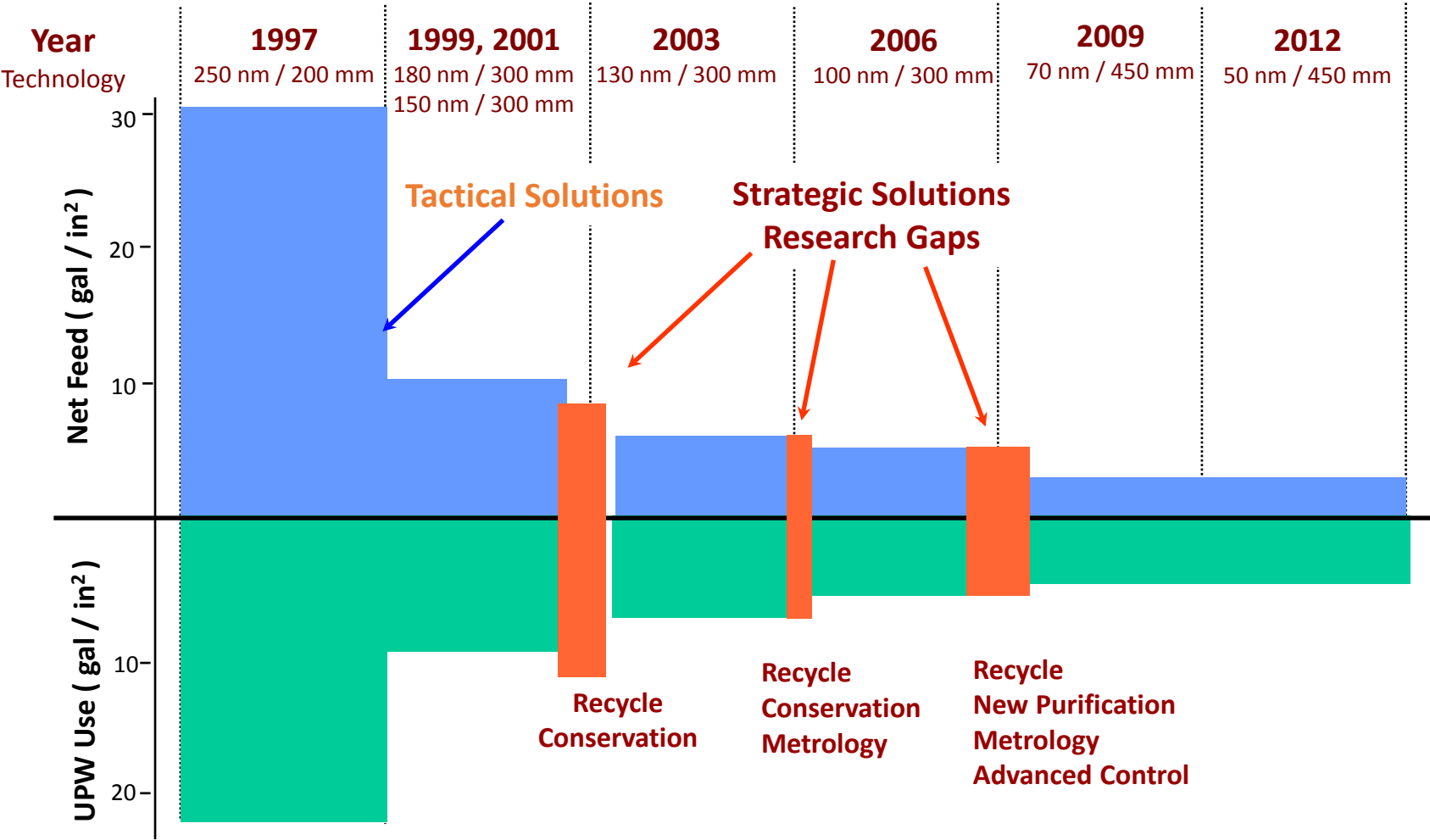




# **Some industries are actually ahead of municipal programs**

- **Sustainability Reports (at least some of them have water efficiency information)**
- **Industry type rating systems (See Beverage Environmental Roundtable reports)**
- **ISO 14000 series (environmental standards)**
- **Water Foot Print efforts**

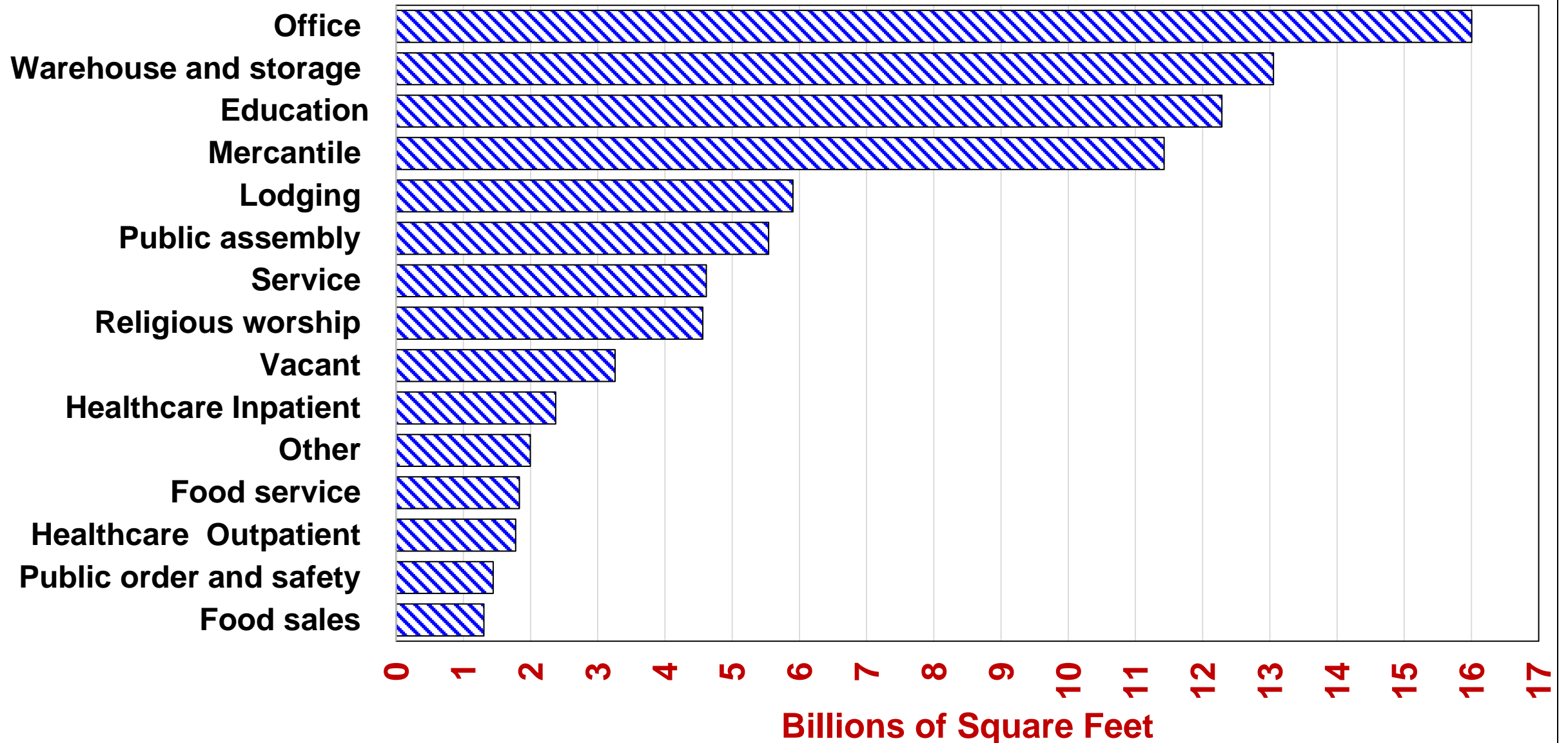
# Trends and Technology Gaps for Water Usage



*So Where Are the*  
**HOLEs?**

# Commercial Buildings in USA

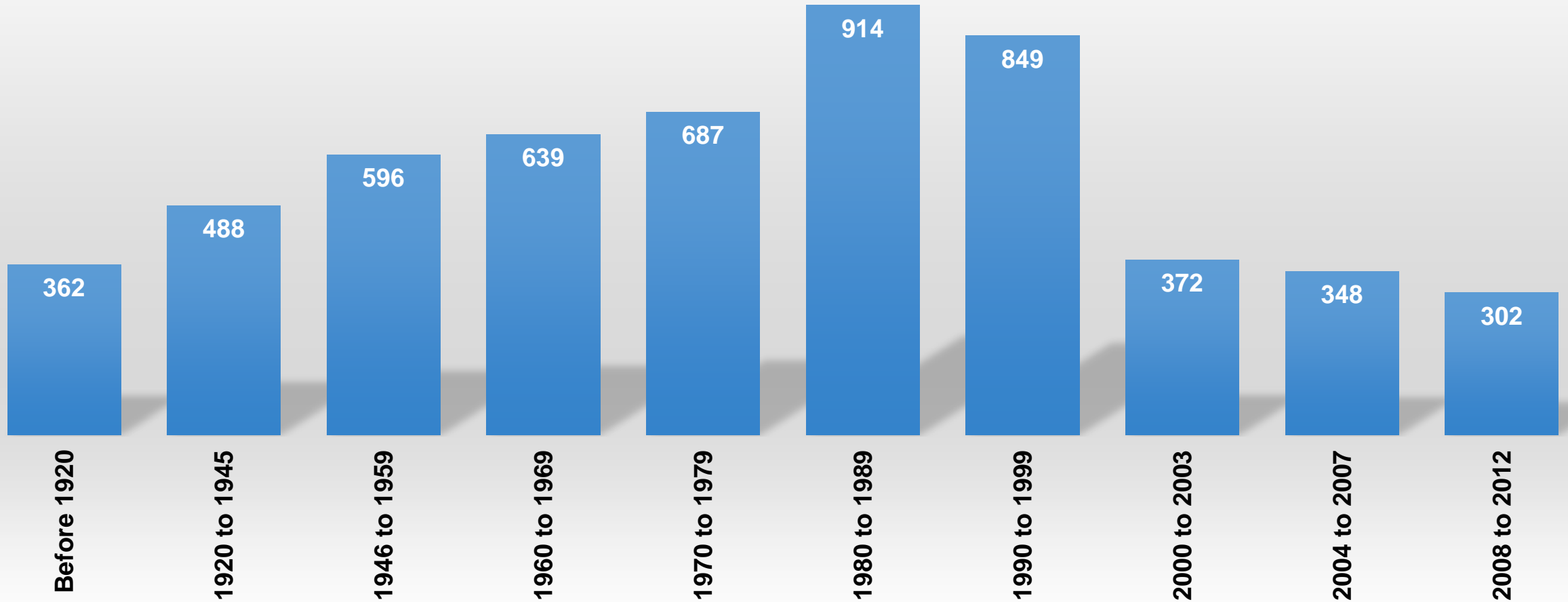
*Billions of Square Feet in 2012*



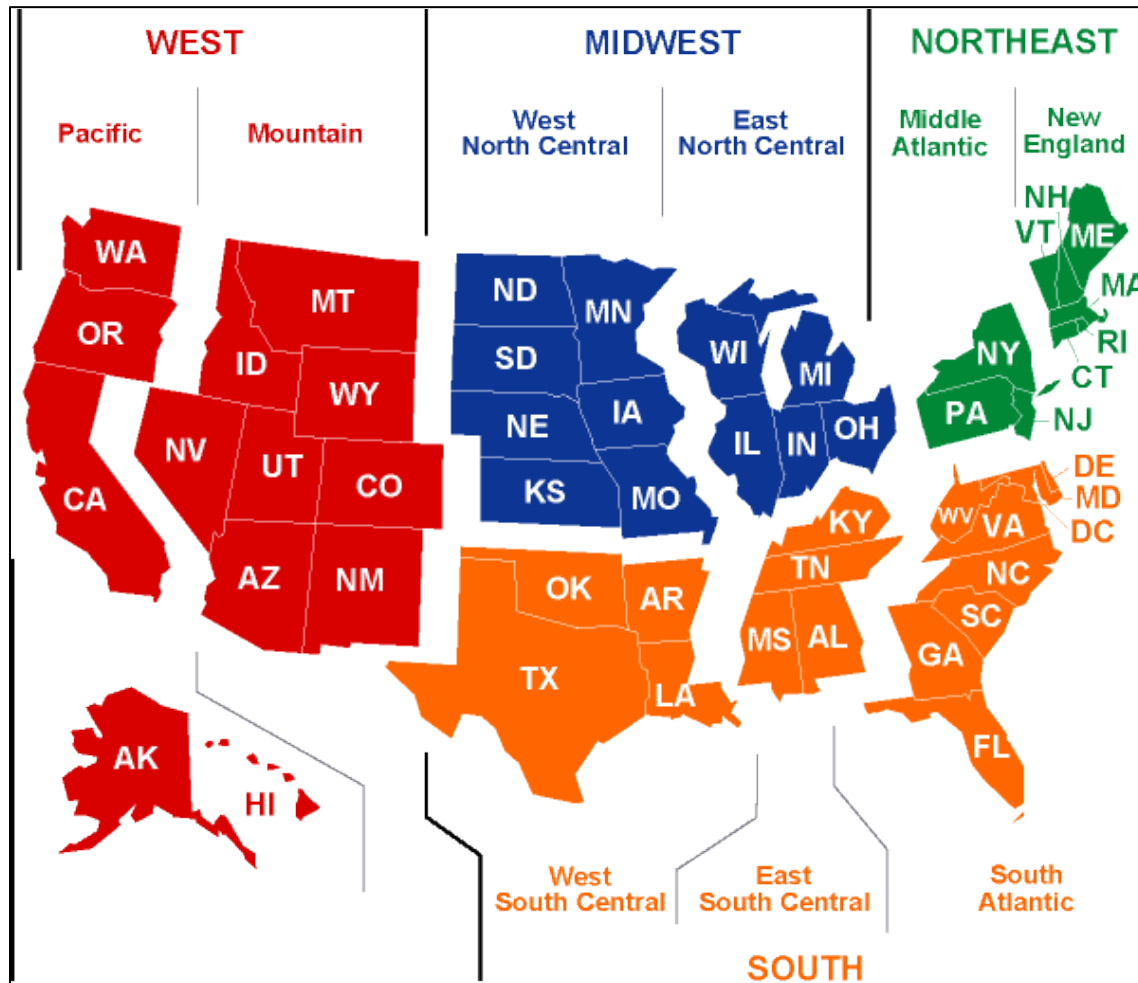
# Histogram of Commercial Building Age

*Thousands of Buildings*

Half of all buildings built before 1980



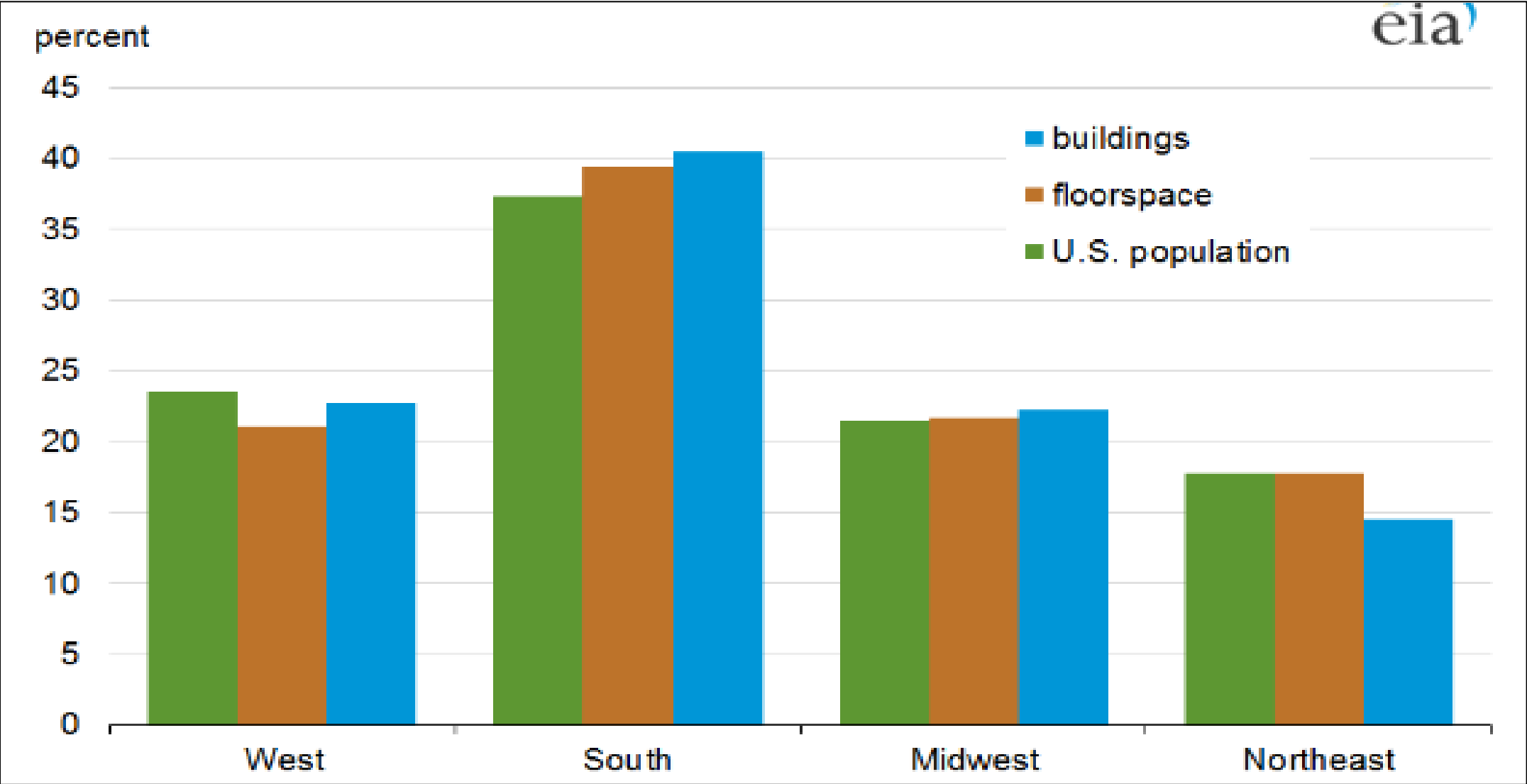
# Top 10 Cities by Population



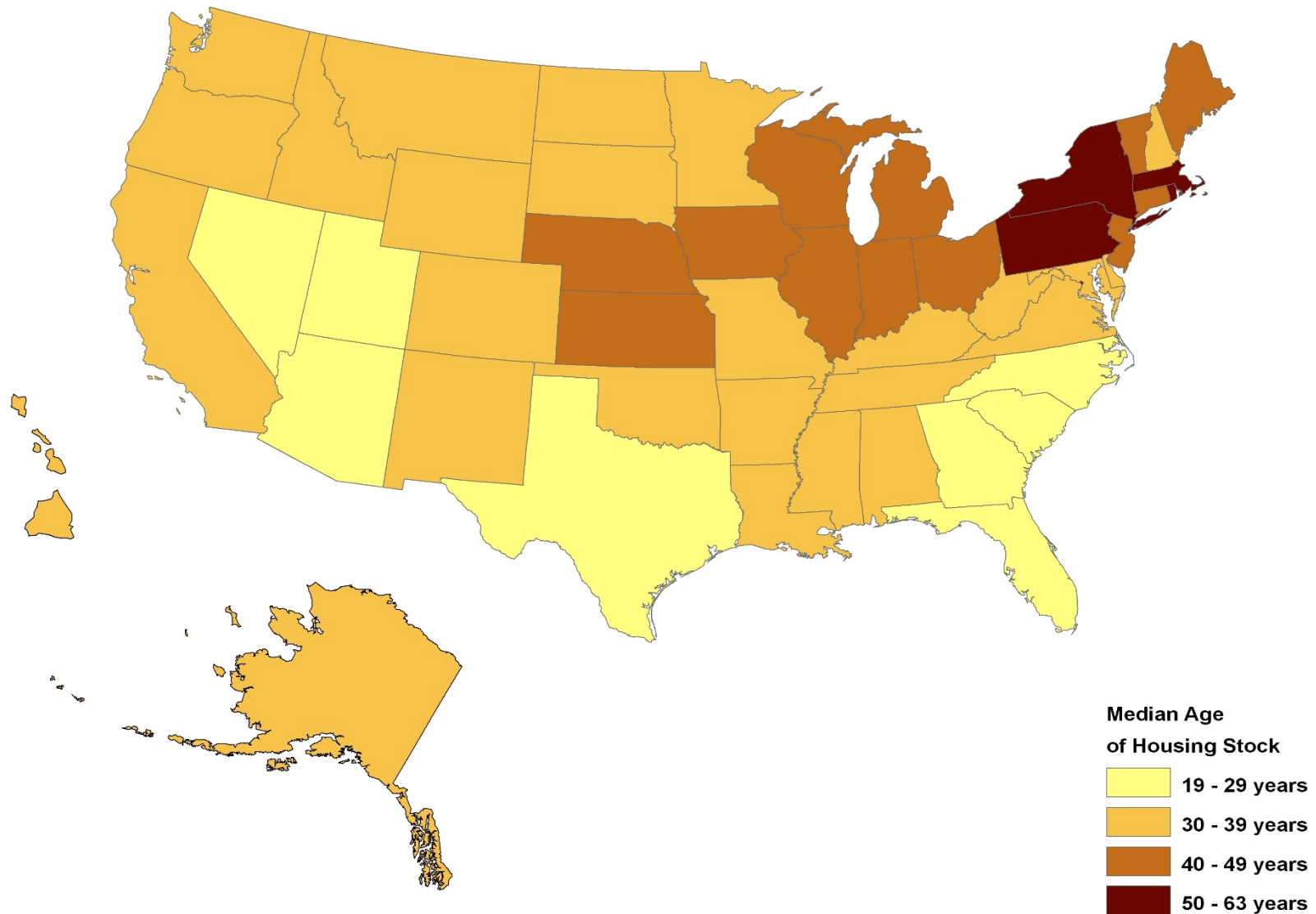
State	1900	1950	2014
New York	2	1	1
Illinois	1	1	1
Pennsylvania	1	1	1
Missouri	1	1	
Massachusetts	1	1	
Maryland	1	1	
Ohio	2	1	
California	1	1	3
Washington DC		1	
Michigan		1	
Arizona			1
Texas			3

# Information for Buildings in 2012 from DOE - EIA

<http://www.eia.gov/consumption/commercial/reports/2012/preliminary/index.cfm?src=consumption> Commercial Buildings Energy Consumption Survey (CBECS)-b1



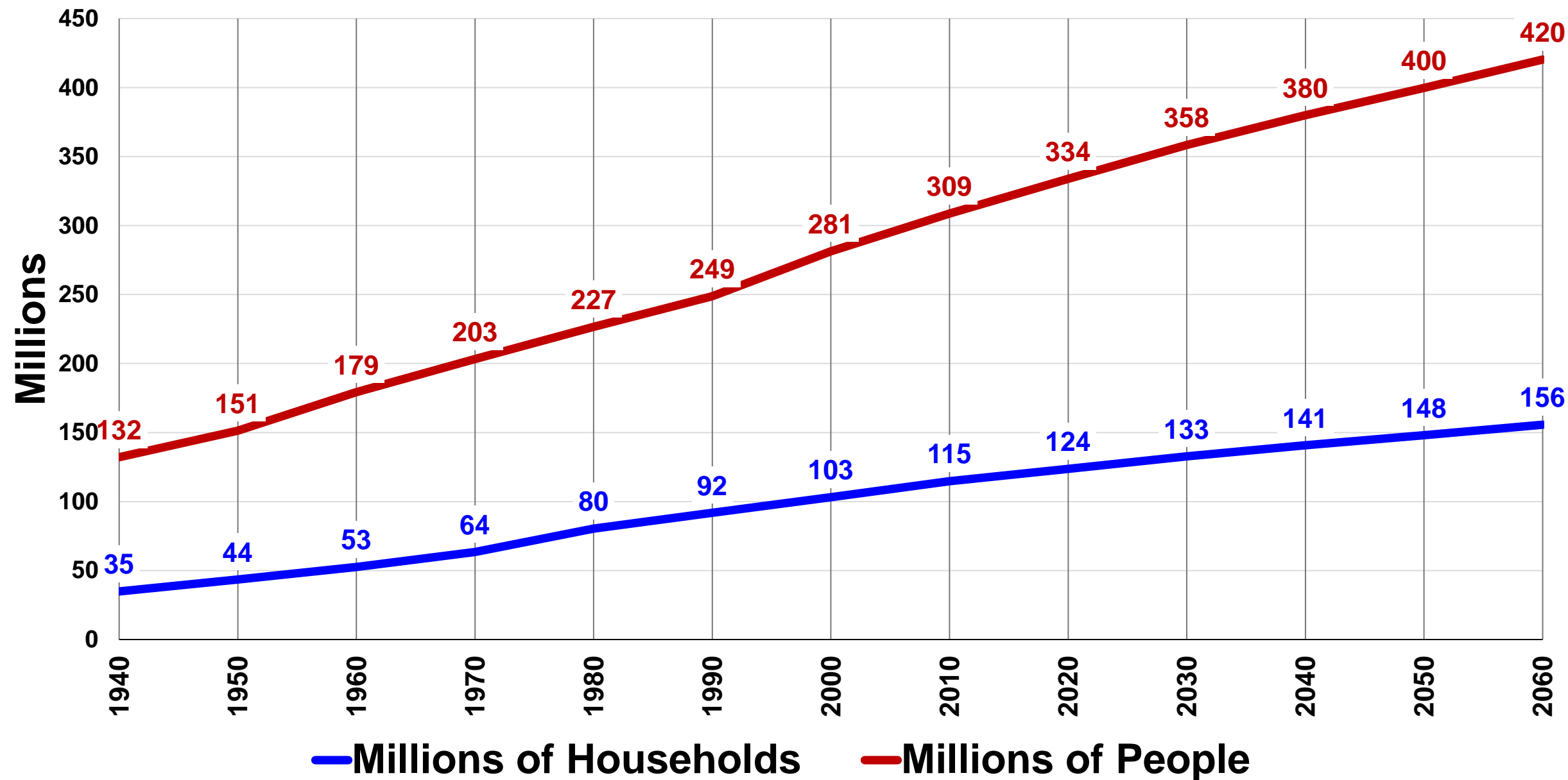
# Median Age of Housing Stock



Source: American Community Survey, 2010



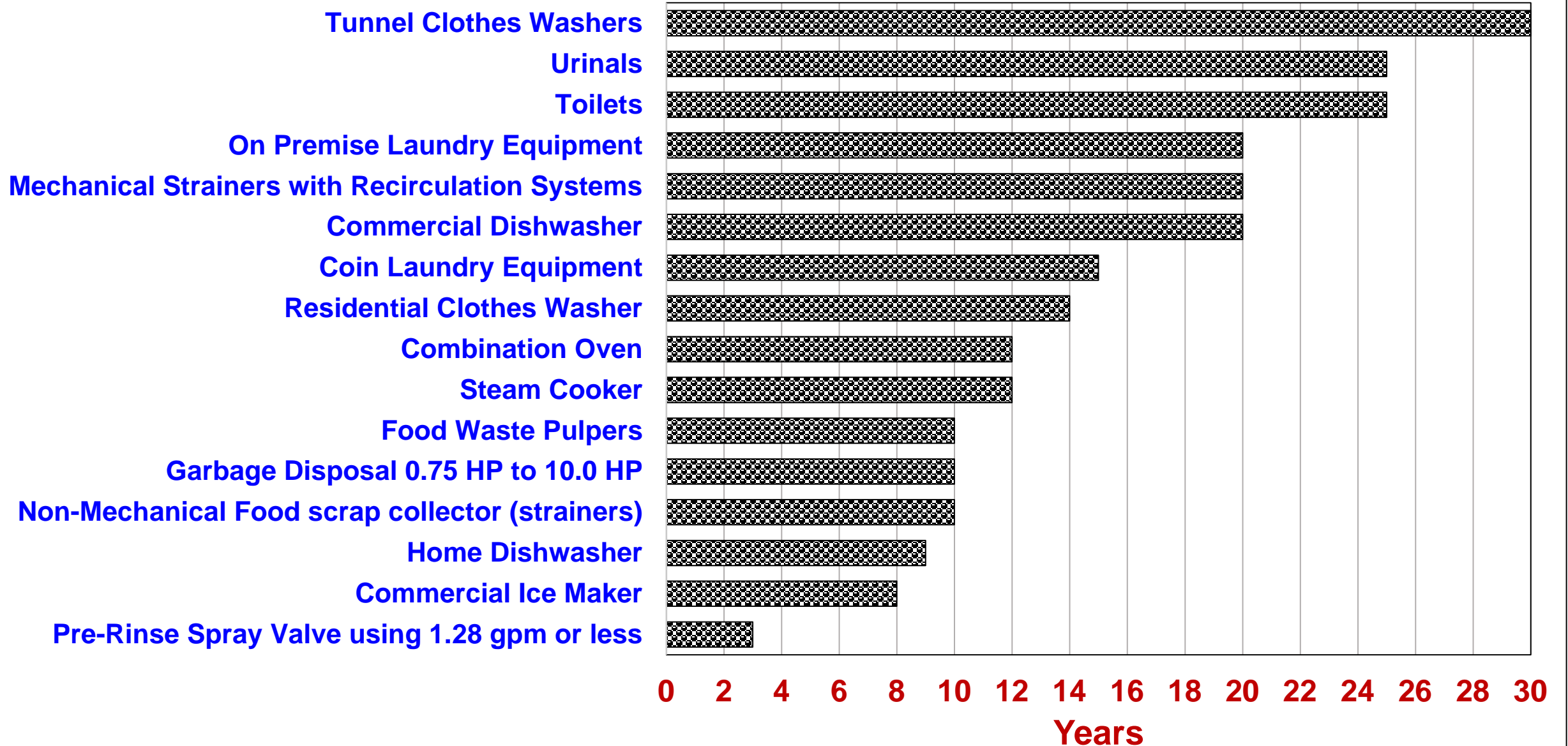
# Population and Housing Statistics for USA



# **Green codes, standards, and Federal requirements are key.**

- **For new homes and businesses**
- **For retrofits and rebuild of existing homes and businesses**
- **For replacement of appliances and fixtures**
- **For storm water control and use of alternate sources of water**

# Average Life of Appliances



# Reduction in Water Use Since 1980



Has your community adopted the

*green*  
*supplements*

*Yet*

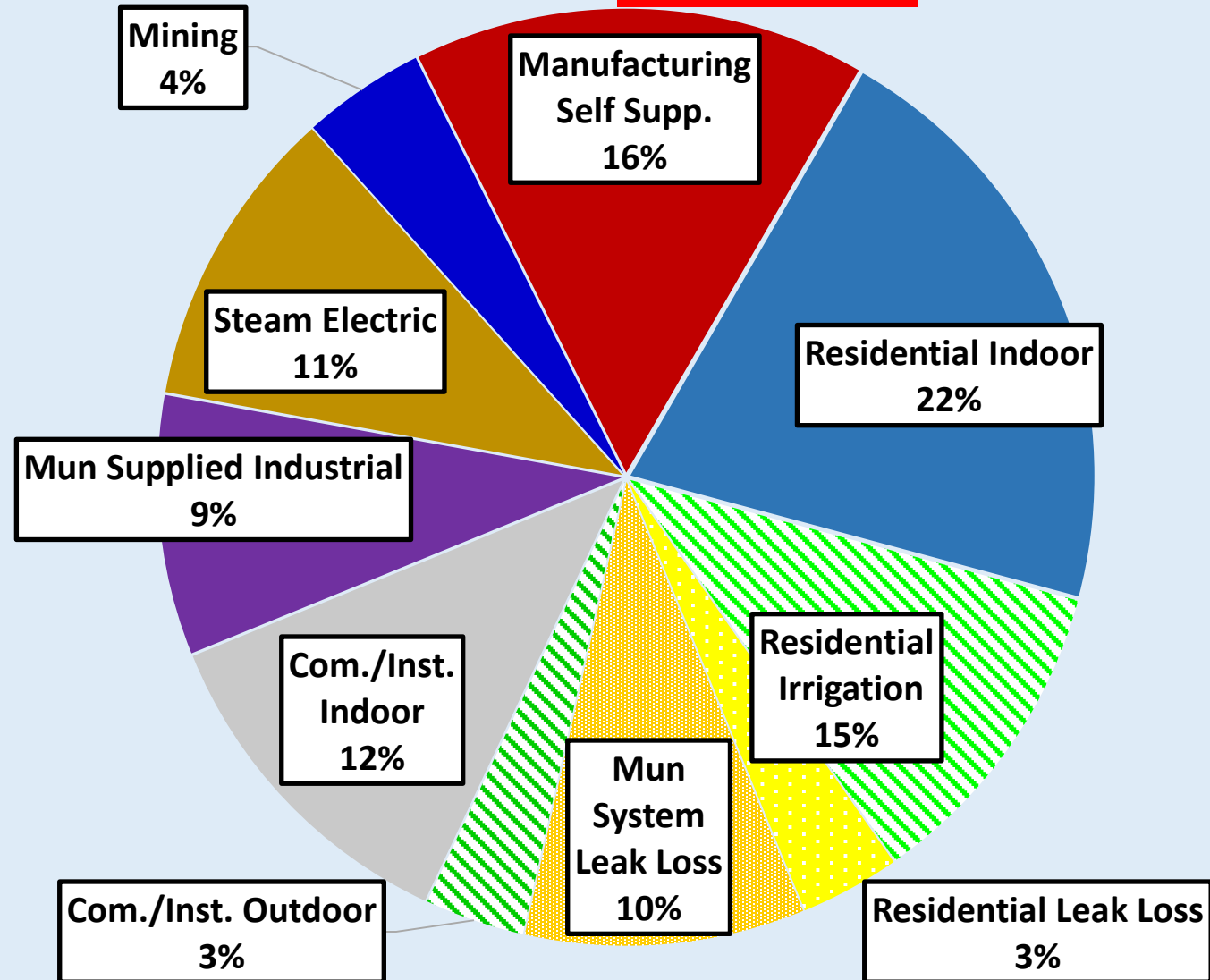
???????

# USGS 2005 Information

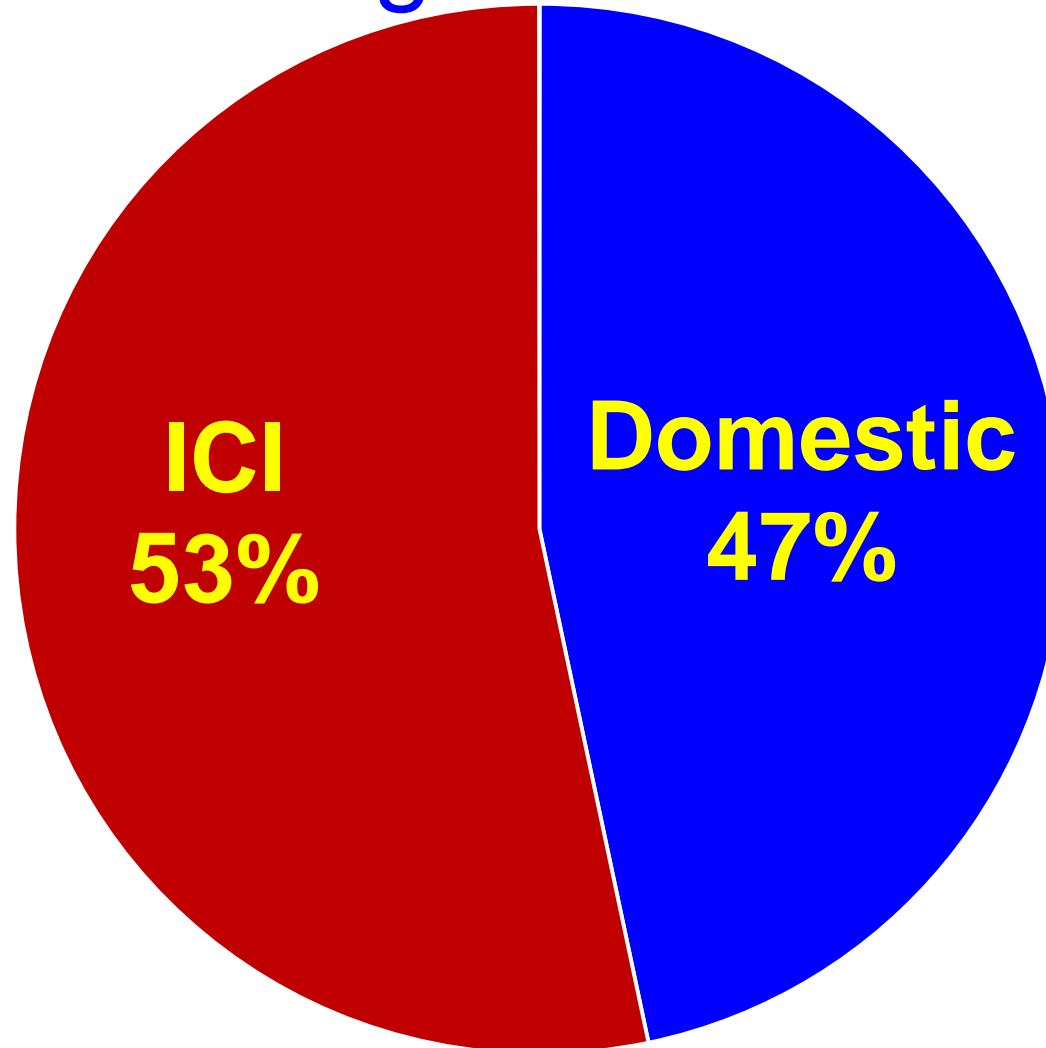
- 57% of use in 15 smaller cities across the USA was for domestic use.
- This means that 43% was for something else.
- ICI and Leaks are the major components of this.

# Non-Agricultural Water Use in Texas

*ICI = 55%*



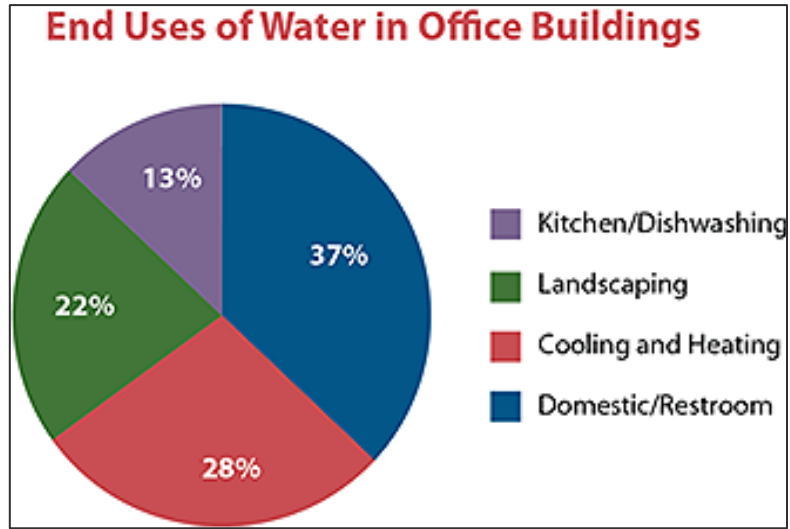
# USGS *Consumptive* Uses Estimates for Non-Agricultural Uses



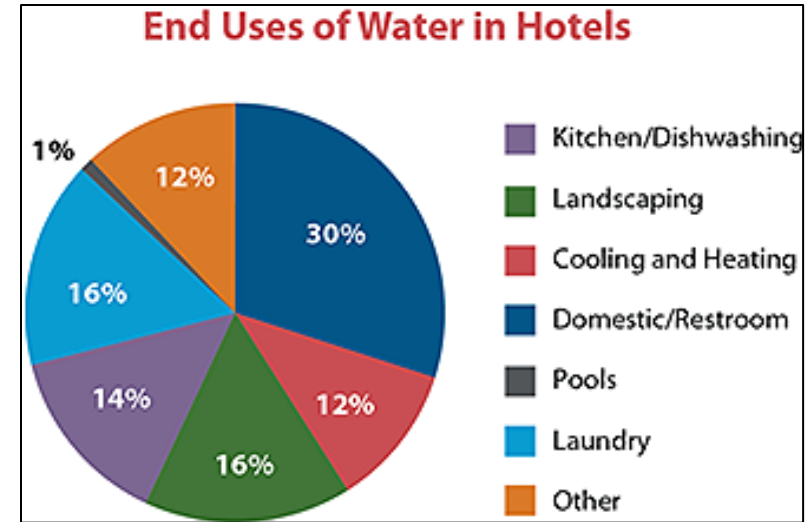


***We are just getting  
started with  
commercial,  
institutional, and  
industrial programs!***

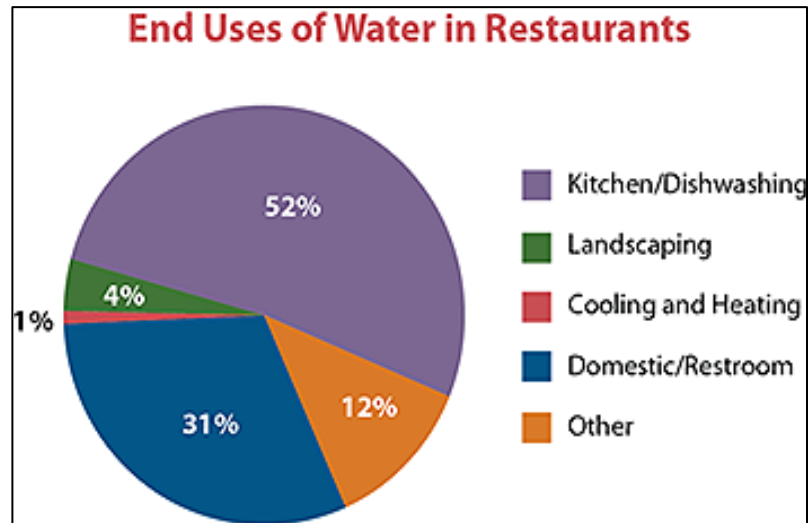
# EPA WaterSense National Averages



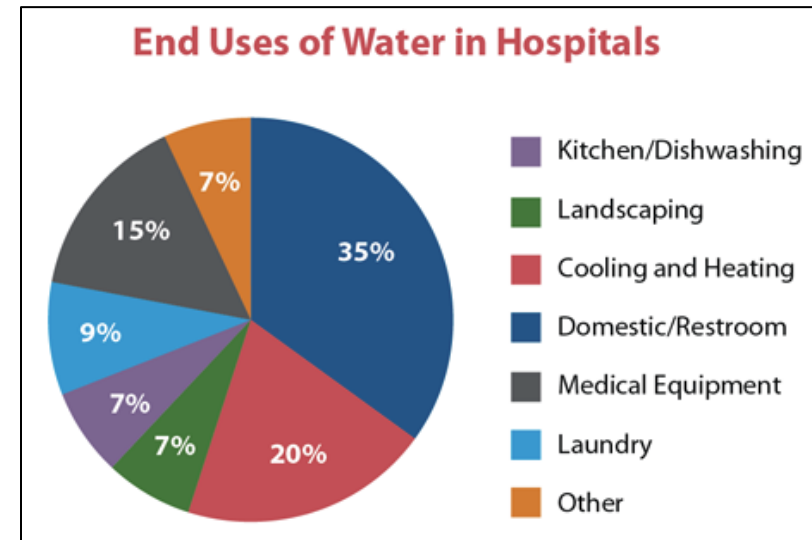
<http://www.epa.gov/watersense/commercial/types.html#tabs-office>



<http://www.epa.gov/watersense/commercial/types.html#tabs-hotels>



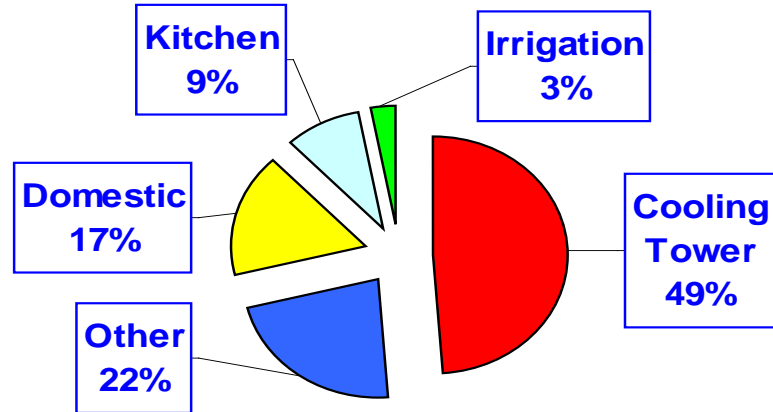
<http://www.epa.gov/watersense/commercial/types.html#tabs-restaurants>



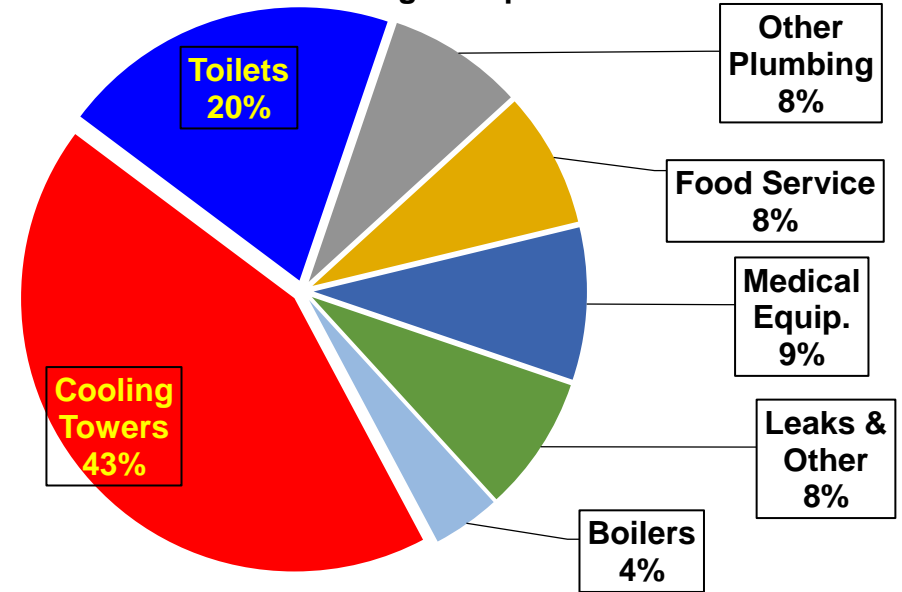
<http://www.epa.gov/watersense/commercial/types.html#tabs-hospitals>

## Grocery Store Water Use in California

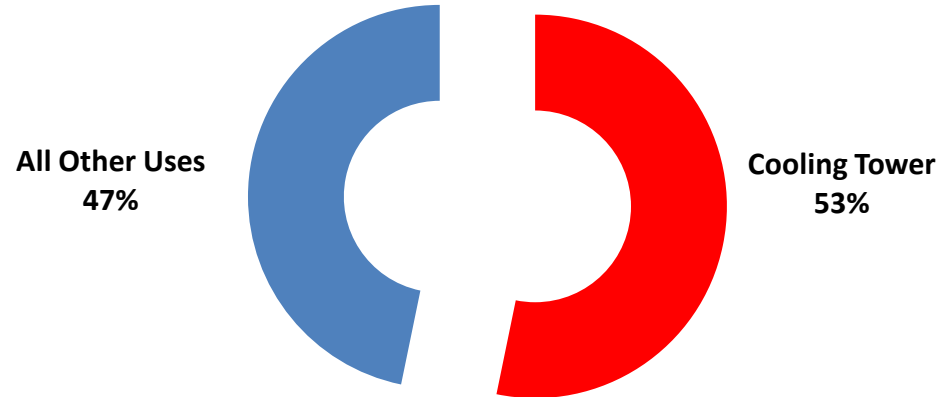
*Pacific Institute*



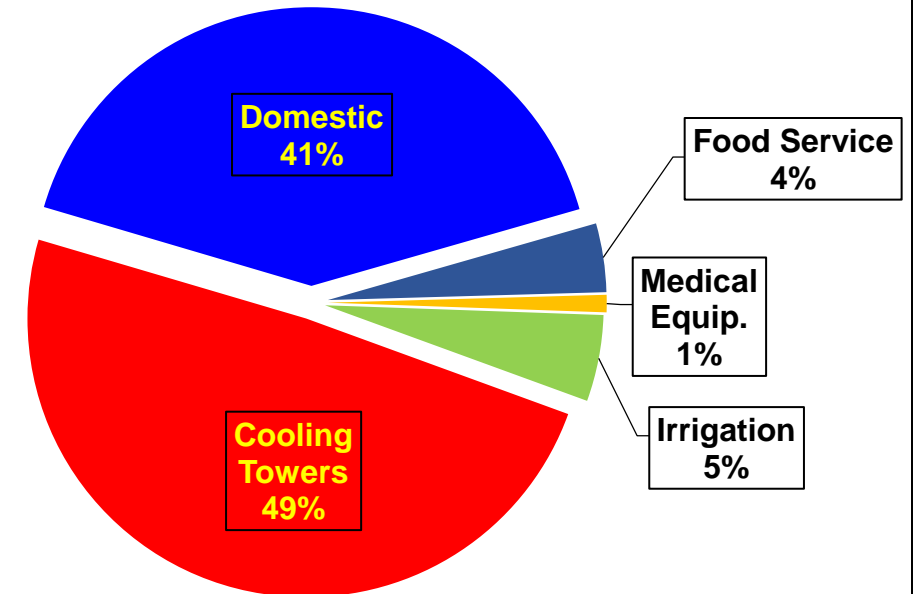
## A Large Hospital in Florida



## Eleven Office Buildings in Austin, Texas



## A Large Hospital in Arizona



# **Leaks** are one of the largest water users in the USA!

One of every **4 - 5**

*gallons that leaves the water treatment plant in the  
average American city will eventually be lost through  
either distribution systems or end user leaks at home  
& work!*

# Metering and Sub-Metering

## NATIONAL GREEN BUILDING STANDARDS & CODES

### Comparison of specific water use efficiency provisions – maximum water use

Metering and Sub-metering	CalGREEN <sup>1</sup> (provisions effective Jan 1, 2014)	ASHRAE SS189.1 <sup>1</sup> (v.2-2011)	ASHRAE S191P (Public review draft v.1)	ICC 700-2008 (with NAHB)	IAPMO Green Plumbing & Mech Code Supplement (v.2-2012)	ICC Green Code (v.1 Final-2012)
Metering tenant water use (usage in gallons per day)	Where non-residential tenant usage >100g + all bldgs where >1000g	Tenants or buildings where >1,000 g	Tenants or buildings where >1,000 g		Where tenant use is >500 g/day OR high-use occupancy <sup>2</sup> OR total bldg area >50K sq.ft.	Where usage >1,000 g/day
Sub-metering process water use – industrial/commercial (usage in gals per day)		Where usage >1,000 g	Where usage >1,000 g		All where usage >1,000 g	Industrial where usage >1,000 g
Sub-metering ornamental water features, swimming pools, in-ground spas		Make-up water supply to all ornamental water features	Make-up water supply lines		Make-up water supply to swimming pool	Make-up water supply lines
Sub-metering cooling towers		Towers of >500 gpm flow (through-put): make-up and blow-down water supply lines	Towers of >500 gpm flow (through-put)		Make-up water supply	Towers of 100 tons or greater: make-up and blow-down water supply lines
Sub-metering evaporative coolers		Where use in excess of 0.6 gpm: meter make-up water supply	Where use in excess of 0.6 gpm: meter make-up water supply		Where cooler has air flow in excess of 30K cfm	Where use in excess of 0.6 gpm: meter make-up water supply
Sub-metering evaporative condensers					Make-up water supply	
Sub-metering fluid coolers					Make-up water supply	
Sub-metering boilers		Steam & hot water boilers rated at 500K Btu/hr or more	Steam & hot water boilers rated at 500K Btu/hr or more		Make-up water supply to boilers collectively exceeding 1 mil Btu/hr	Make-up water supply to: boilers drawing more than 100K gallons annually or rated at 500K Btu/hr or more

<sup>1</sup> Prescriptive option only

<sup>2</sup> Occupancy by commercial laundry, cleaning operation, restaurant, food service, medical office, dental office, laboratory, beauty salon or barbershop

# AMI Examples

(left to right)

*Mueller, Badger, Sensus*

1

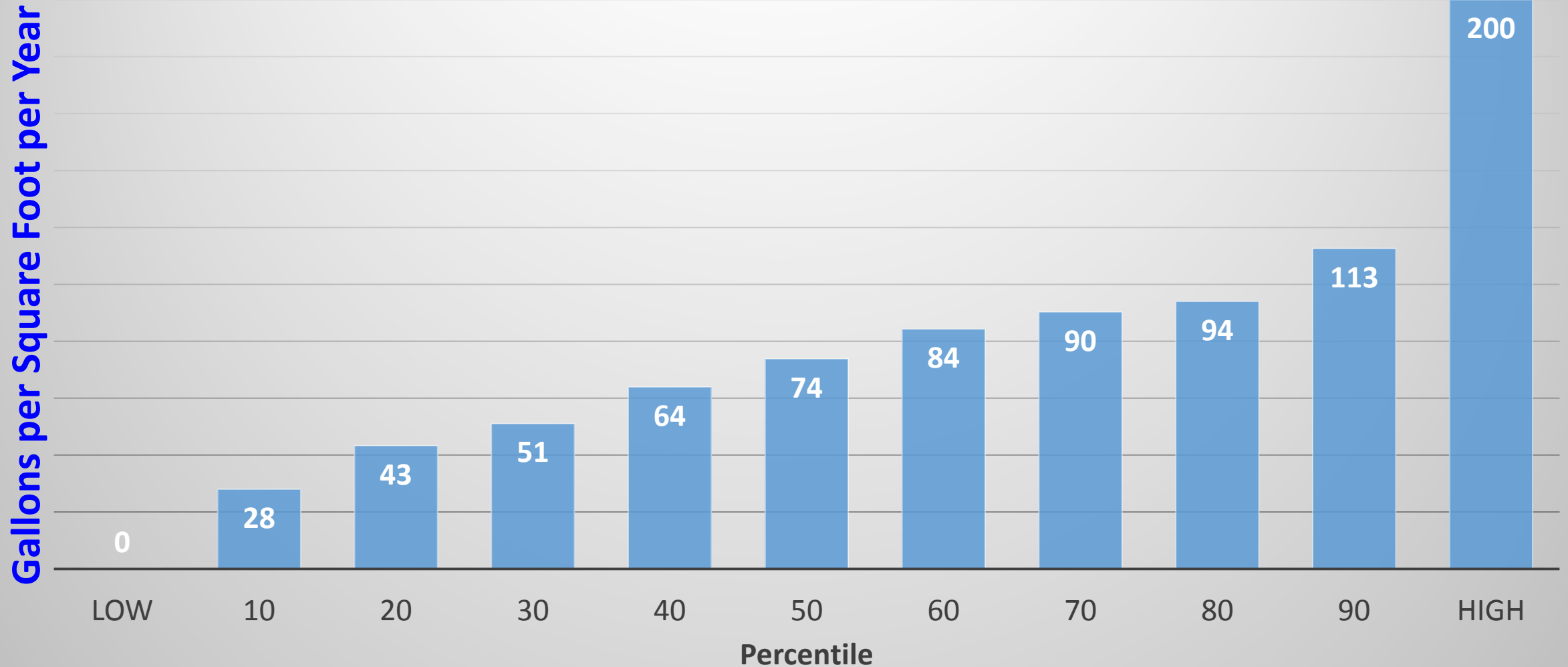


*GALAXY Transmitter  
with Model 25 Meter*



# 66 New York Hotels in 2013

## AMI – Portfolio Manager Data Base







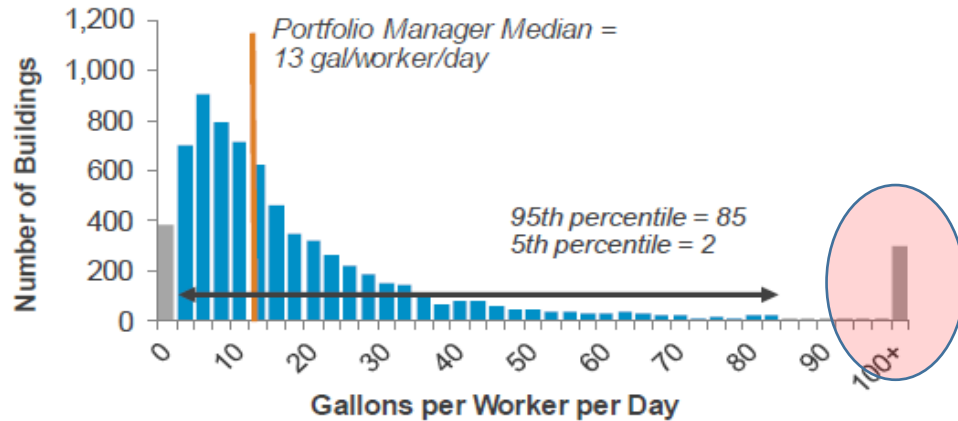


**If you don't  
measure it, you  
can't manage it!**

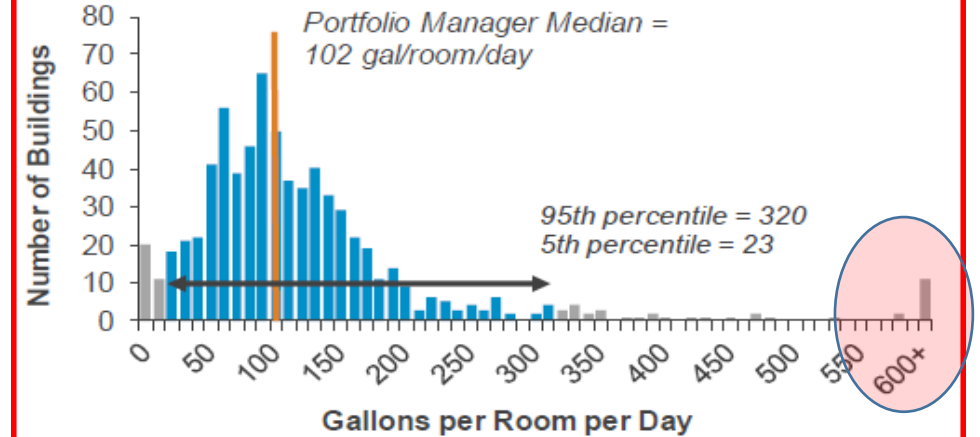
# EPA Portfolio Manager Information on Water



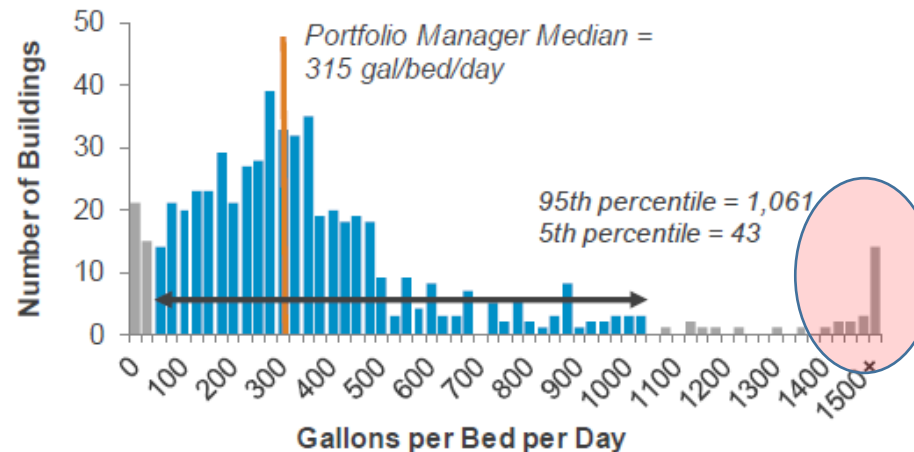
## Office Use Per Worker



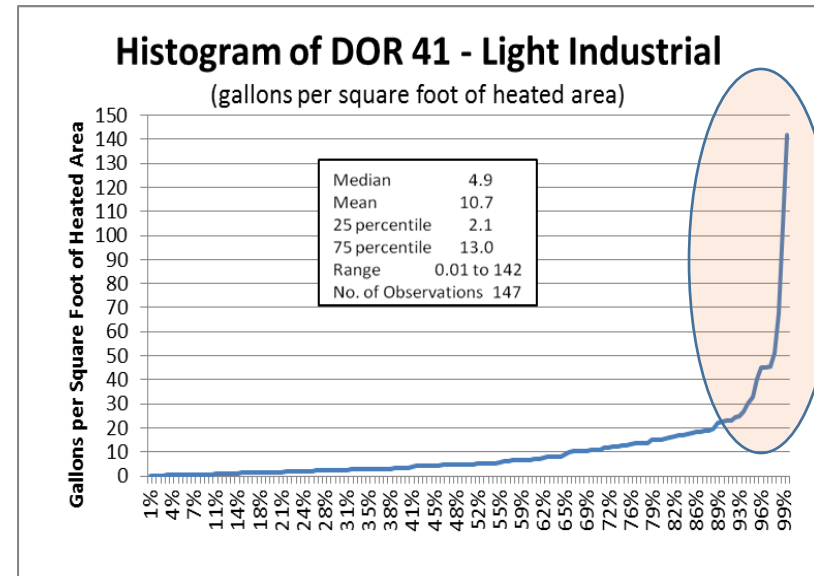
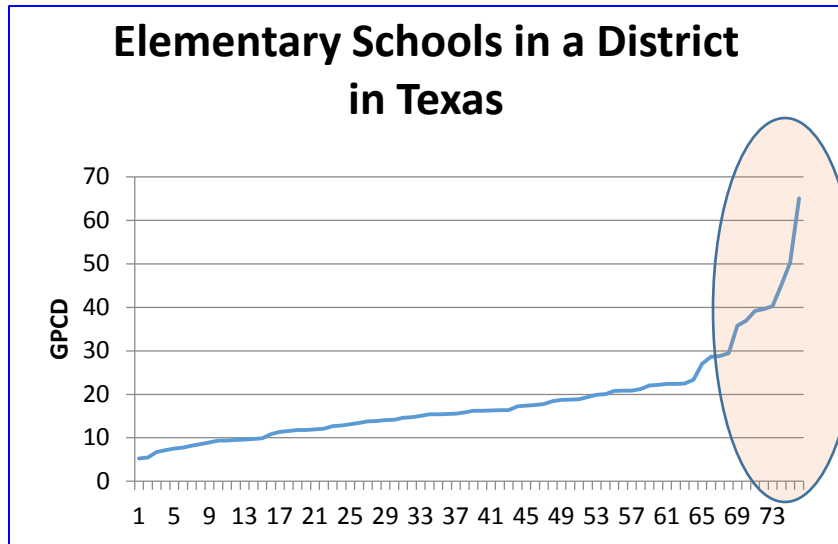
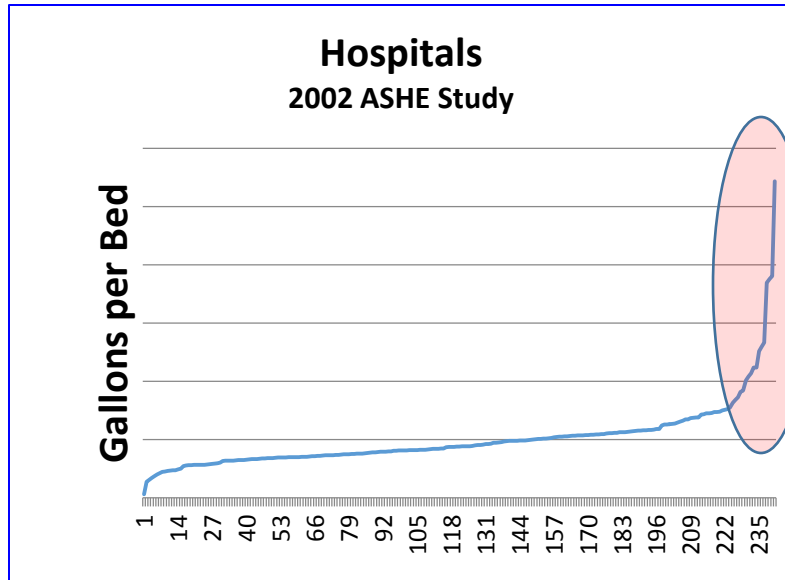
## Hotel Use Per Room



## Hospital Use Per Bed



# Do You see a Pattern Here?



# Alternate Sources of Water

- **Municipally Reclaimed Water**

- **Gray Water (untreated)**

- **Rainwater**

- **Alternate On-site Sources**

Treated graywater, on-site wastewater reuse, A/C condensate, foundation drain water, swimming pool backwash, RO reject water, stormwater, etc.

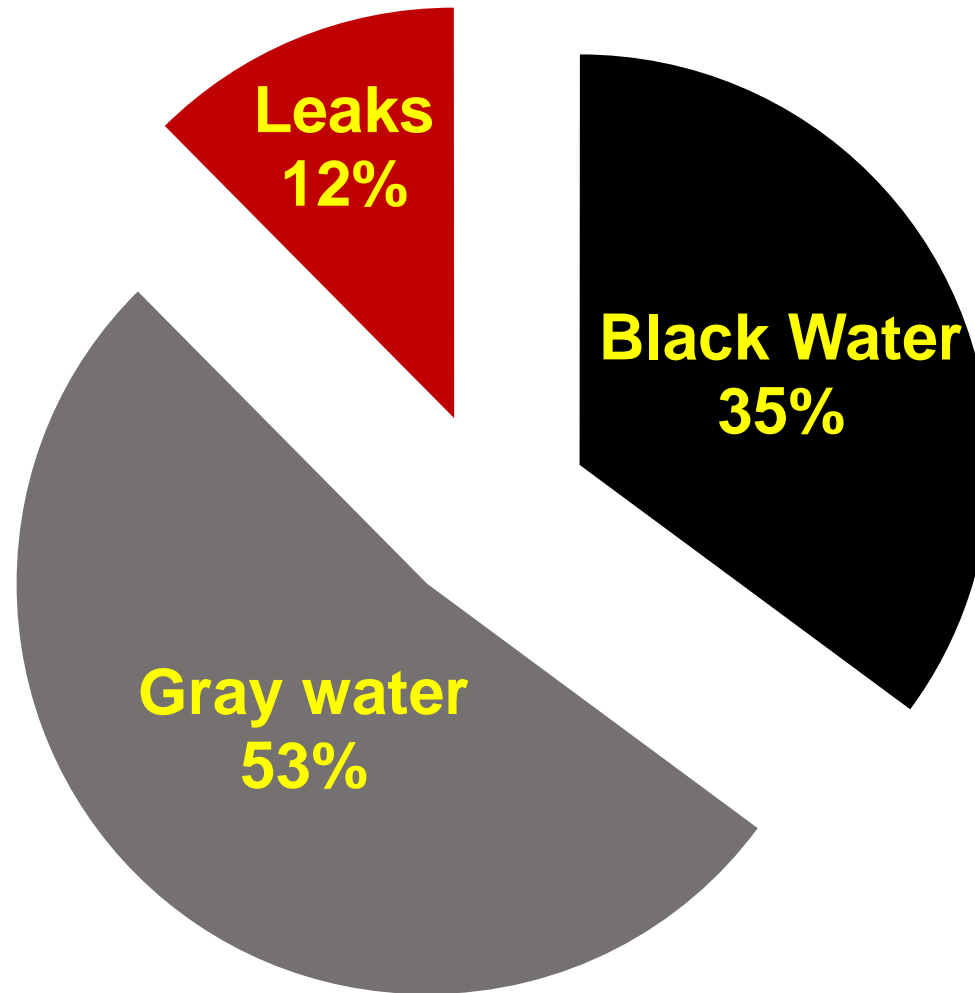
# On-Site Reuse and Sources are the Next Big Push



- Rainwater harvesting
- Storm water harvesting
- Air conditioner condensate
- Swimming pool filter backwash
- Cooling tower blowdown
- RO & NF reject water
- Gray water
- On-site wastewater systems
- Foundation drain water
- Others??????

# Average American Household Indoor Use

*EPA estimates that about 1/3 of residential use is outdoor*





# And of course Irrigation

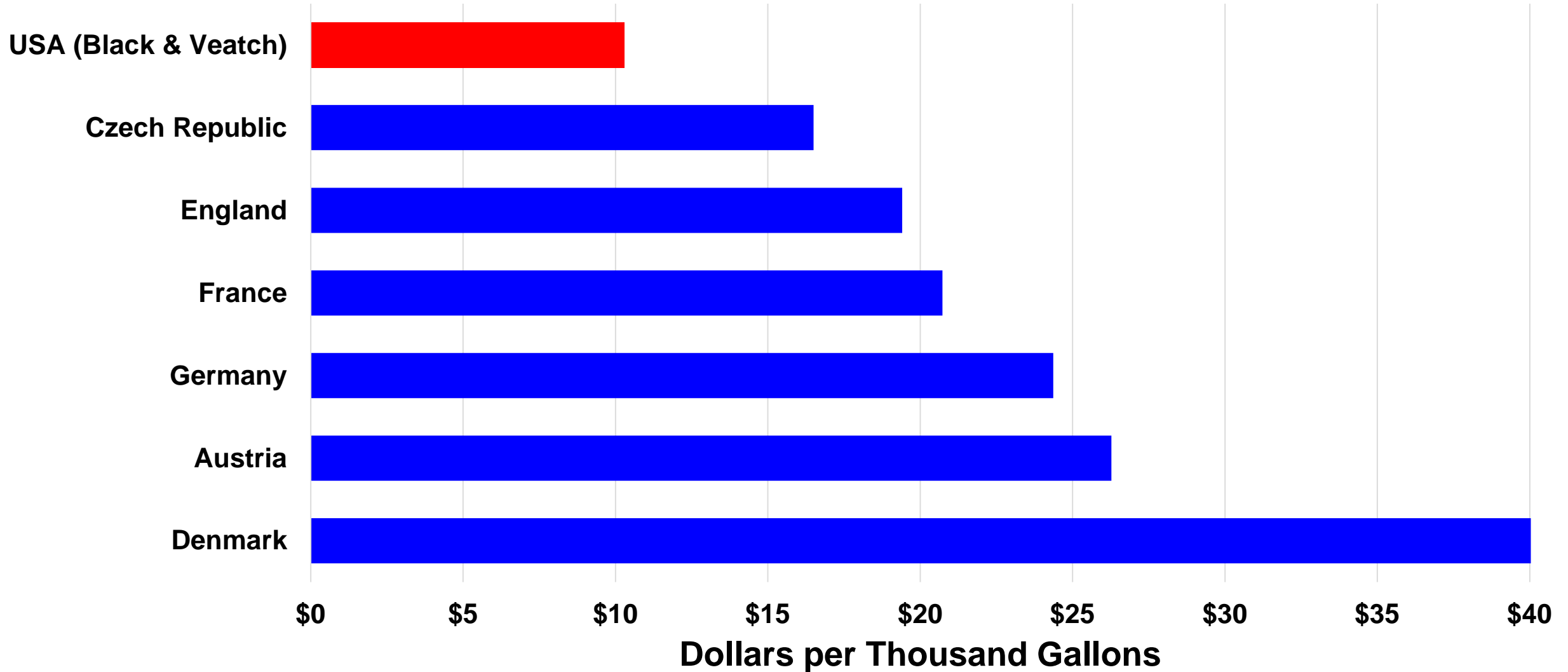


# Average Residential Water and Sewer Rates in European Countries Compared to USA

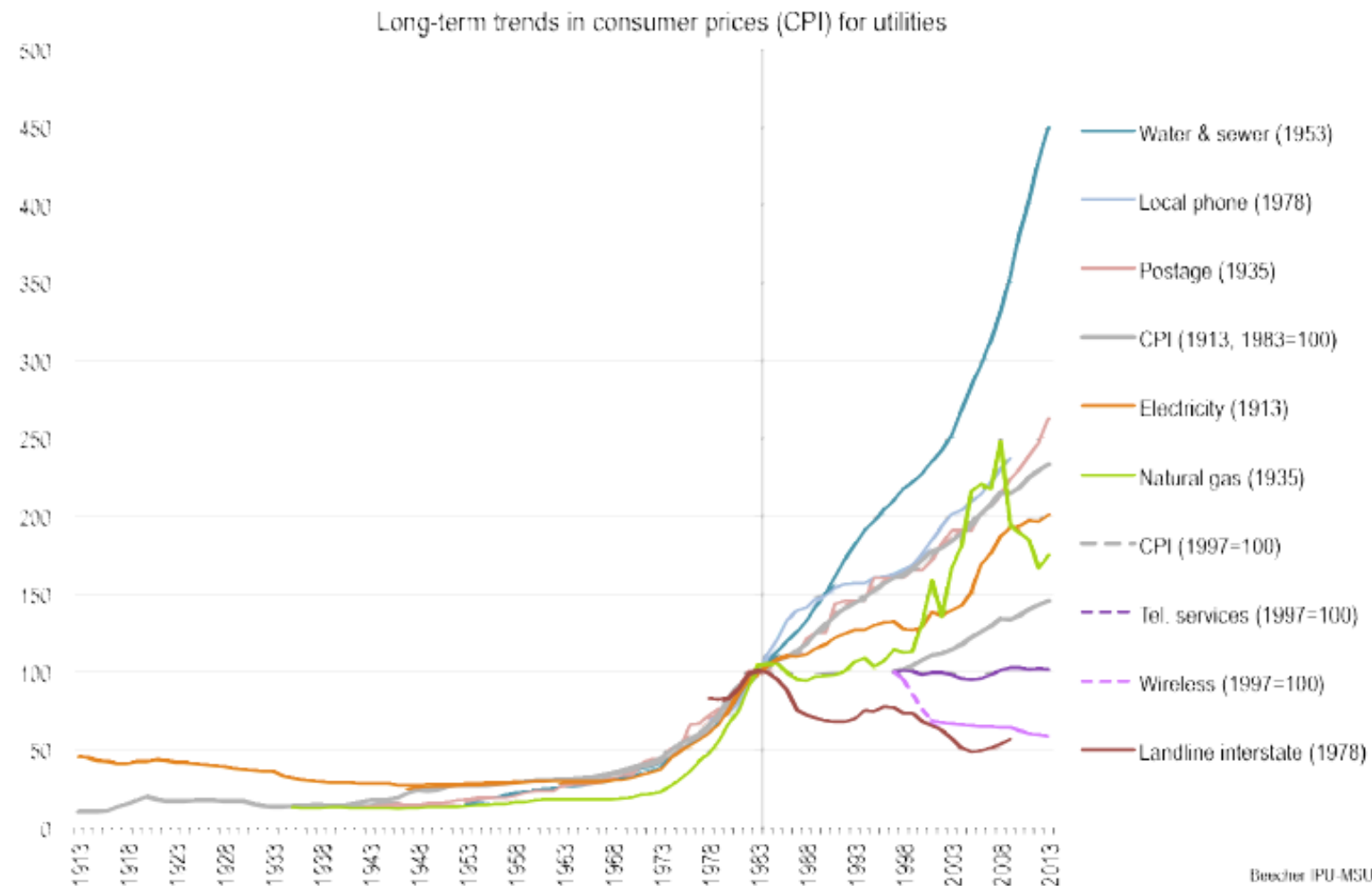
Sources of Information:

Europe - <http://www.globalwaterintel.com/archive/12/9/market-profile/global-water-tariffs-continue-upward-trend.html>

USA - <http://bv.com/docs/management-c>

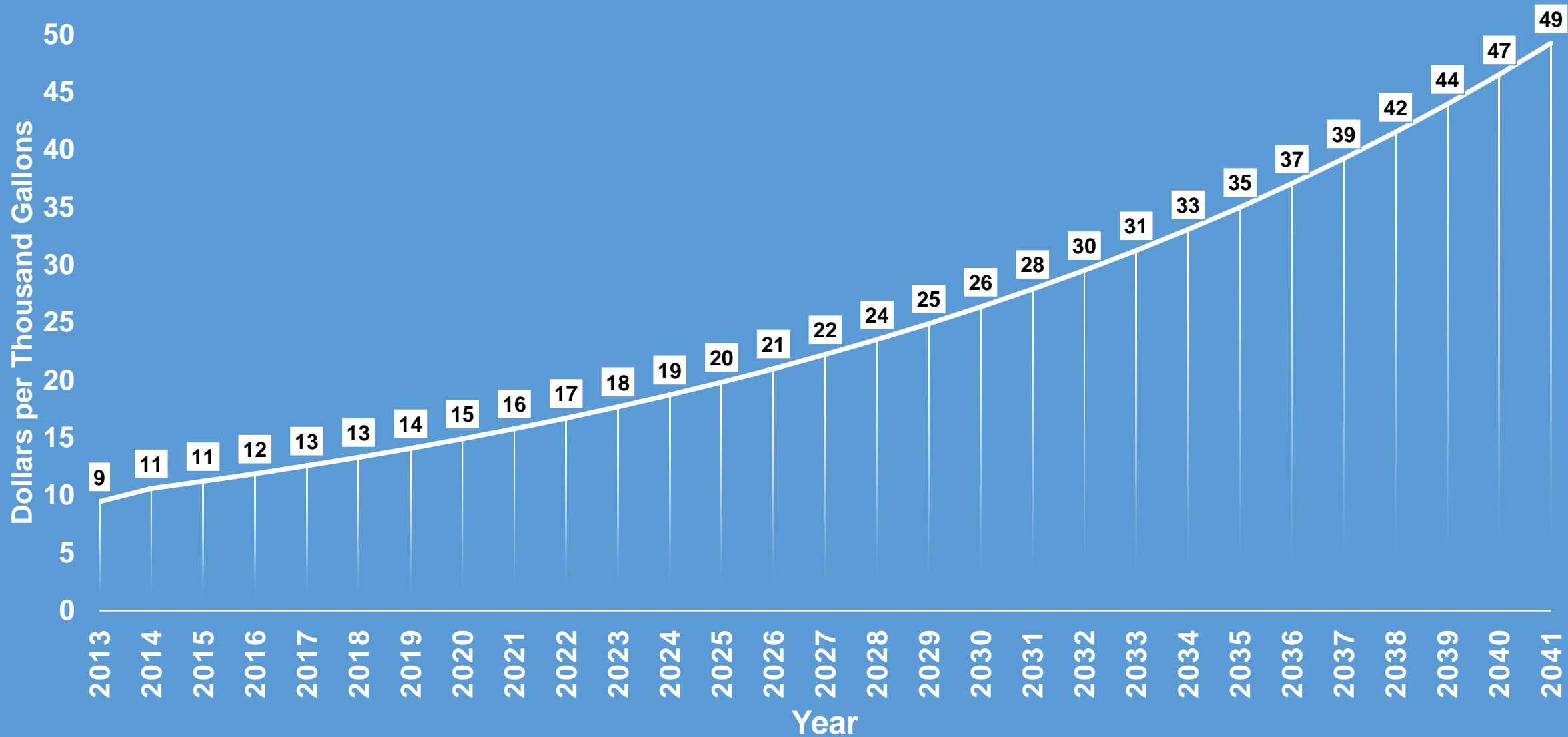






**Exhibit 1. Long-term trends in the Consumer Price Index (CPI) for utilities (1913-2013).** The index is set to 100 for 1982-1984 except for telephone and wireless services, where the index is set to 100 for 1997. Year (\*) indicates start of series.

# PROJECTED FUTURE COST OF WATER AT CURRENT INFLATION RATE OF 5.85%



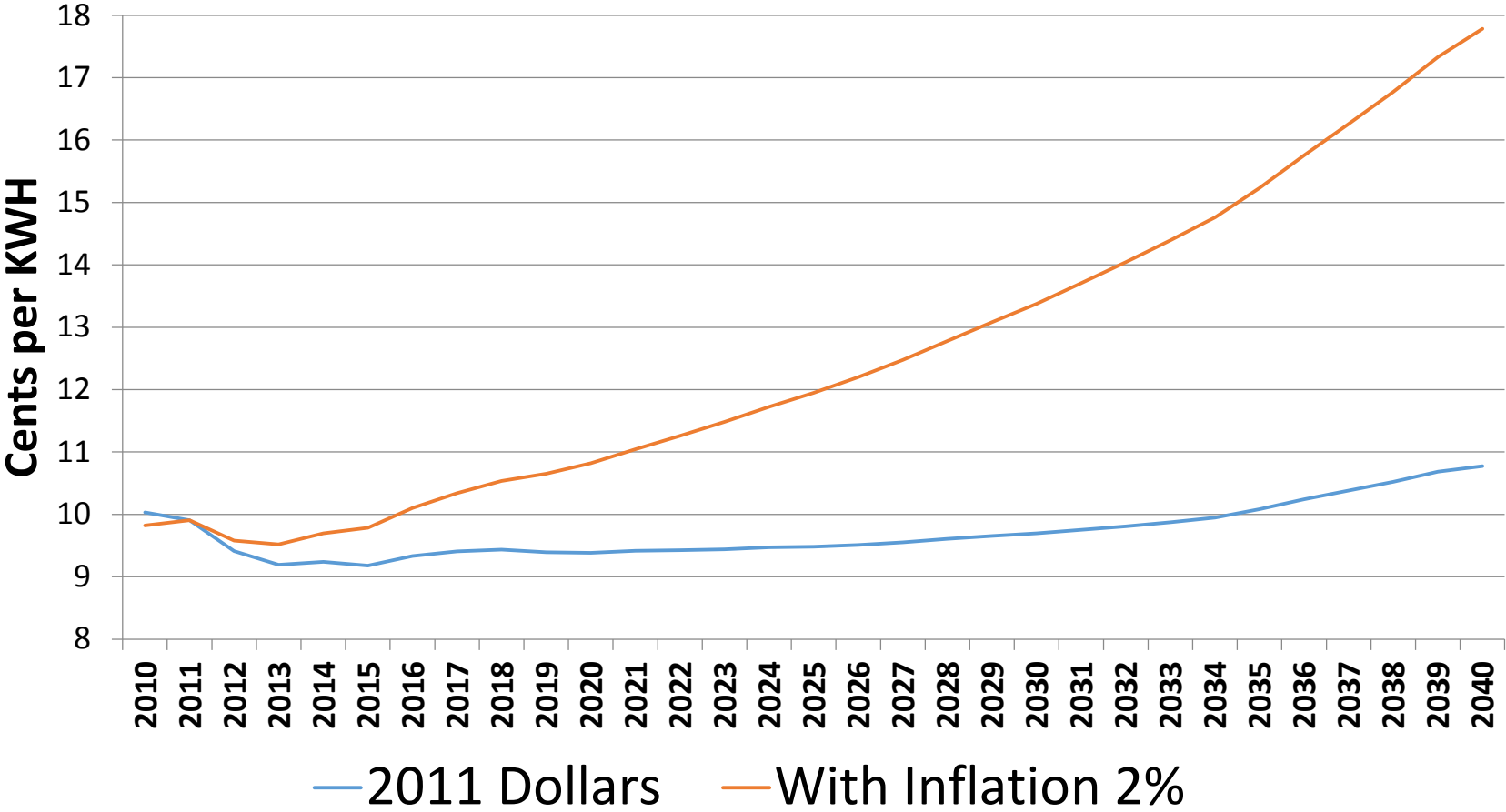
# Cost to Flush a Toilet at Current Inflation Rate of 5.85%

Gallons per Flush	Cents per Flush in 2014	Cents per Flush in 2034
5	4.9	15.4
3.5	3.4	10.8
1.6	1.6	4.9
1.28	1.2	4.0

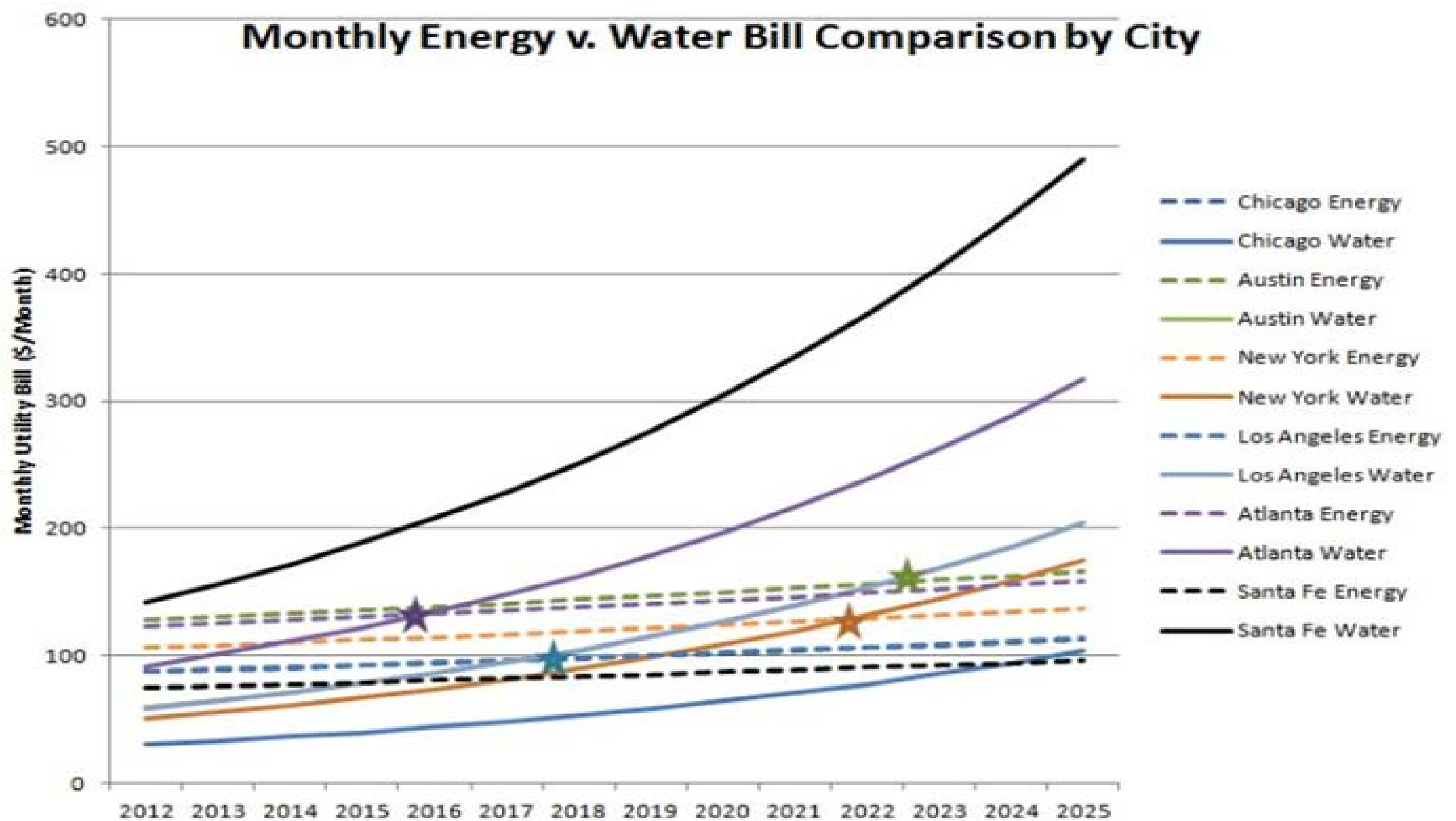
# Cents per KWH

(With & Without Inflation)

Energy Information Administration

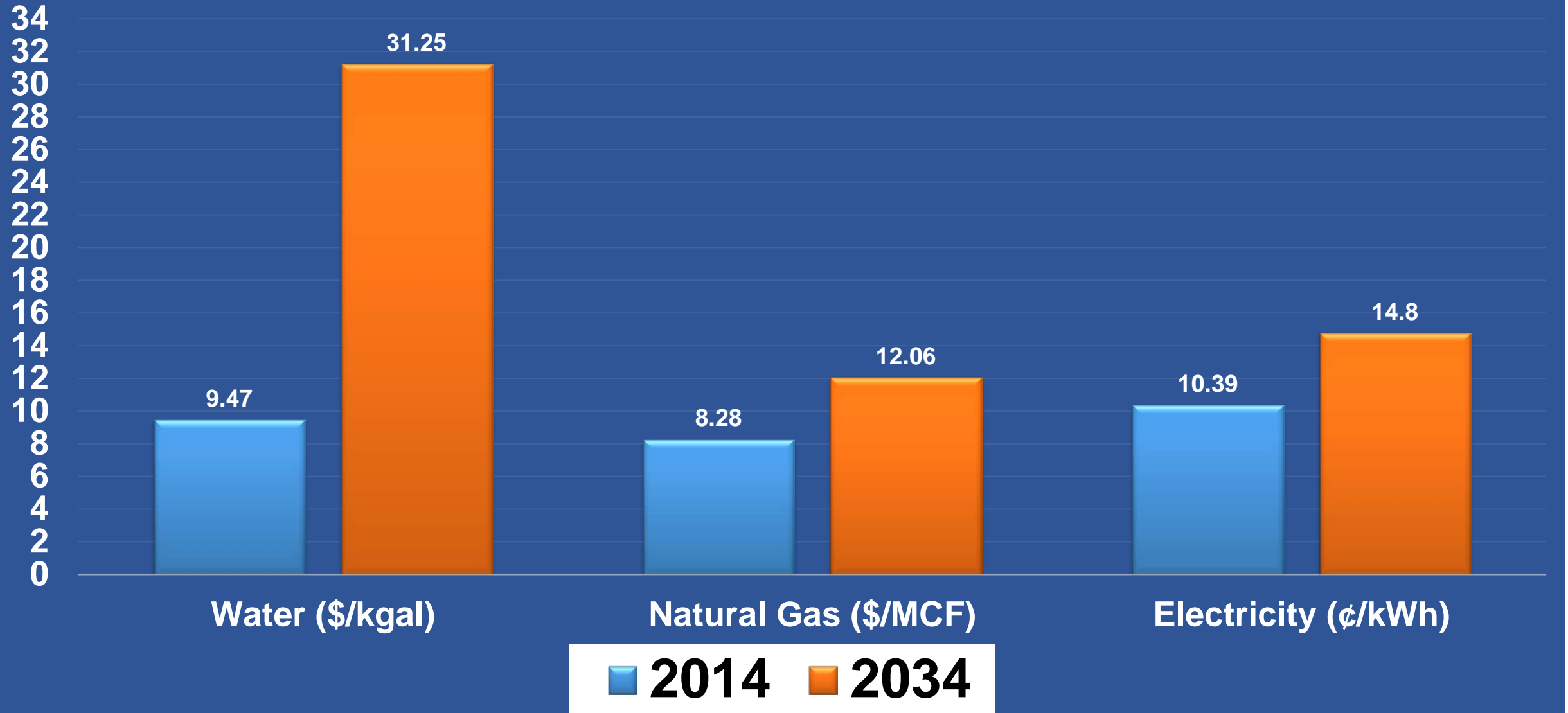


# Monthly Energy v. Water Bill Comparison by City

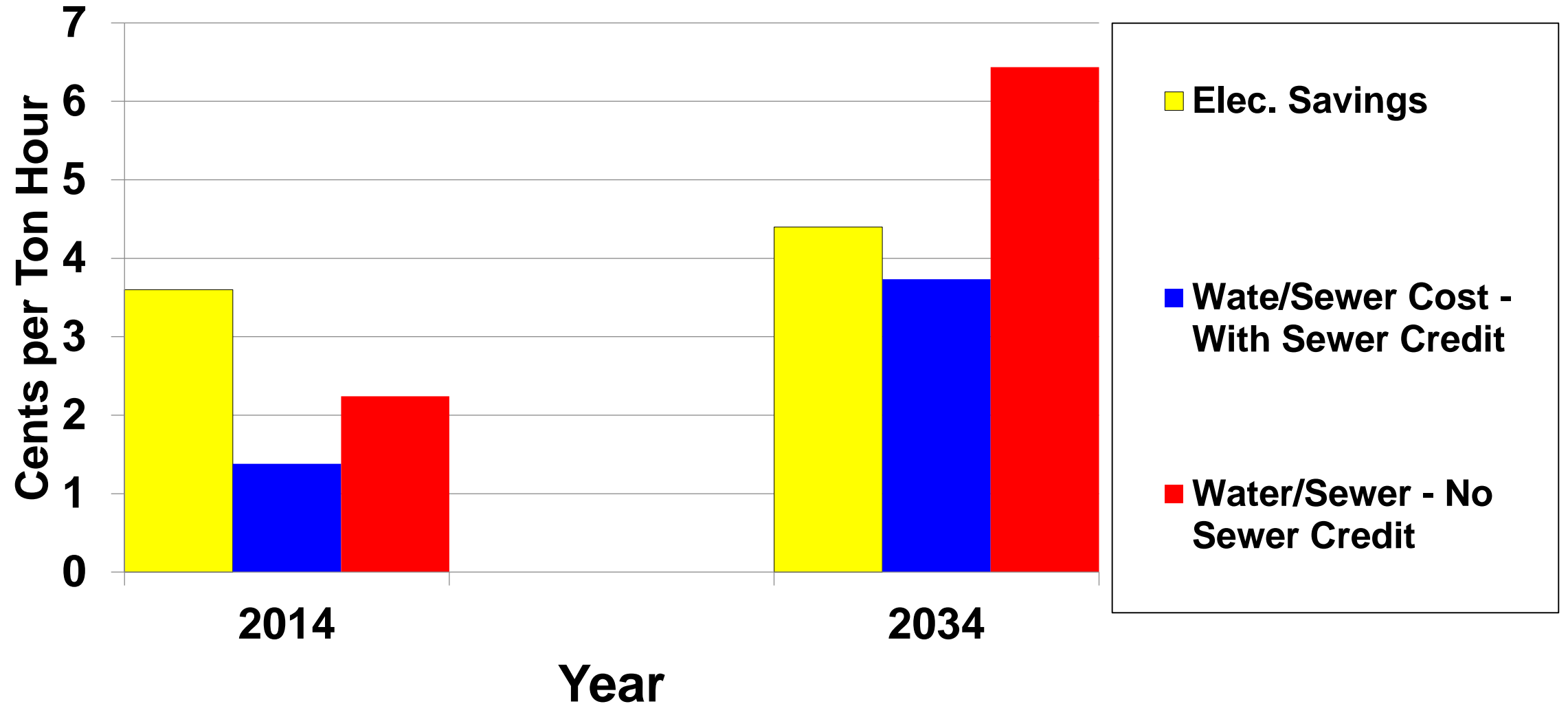


# Projected Future Costs

(water = 5.85%, Electricity & Nat. Gas = 2%)



# Cooling Tower Energy and Water/Sewer Cost per Ton Hour



**So What Does the  
Future Hold for Water  
Conservation?**



**We have  
opportunities  
galore!**

# So have we just harvested the *low hanging fruit*?

- Some of it, but not all of it has been harvested.
- There is a whole lot left to be done.
- We all need to get more technical.
- The new “best fruits” now tend to *hang higher on the tree*.
- ICI, non-revenue water, alternate sources, implementing green codes and similar “higher on the tree” opportunities are where the future is at.
- But the old standby measures are still important too.

# Things that need to be done.

*At least as Bill Hoffman sees it.*

- The profession of water conservation – Development and Formalization
- The need for academic research, courses and degree plans
- Changing emphasis to include **ALL** urban water uses
- Continued emphasis on codes and their implementation
- The need to train facility managers, engineers, and others involved in non-residential facility operations
- The need to measure and sub meter water use on a real time basis
- **FIX THE LEAKS** on both the delivery and end use side

It is up to ***All of Us*** to  
make it happen!

*To use a phrase from the 1970's*

We have just begun!

*But we are going to have to learn to work  
on the fruit higher upon the tree.*





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**GSA Contract # GS-21F-0038T**