This presentation premiered at WaterSmart Innovations

watersmartinnovations.com

watersmart
INNOVATIONS

Past and Future 100 Years

1967 to 2067

Presented by

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First, a basic concept.

Use vs. Consumption vs. Return Flows.

- **Water *Use* *(withdrawal)* is the amount of water withdrawn from a water source (lake, well, river, etc.)**

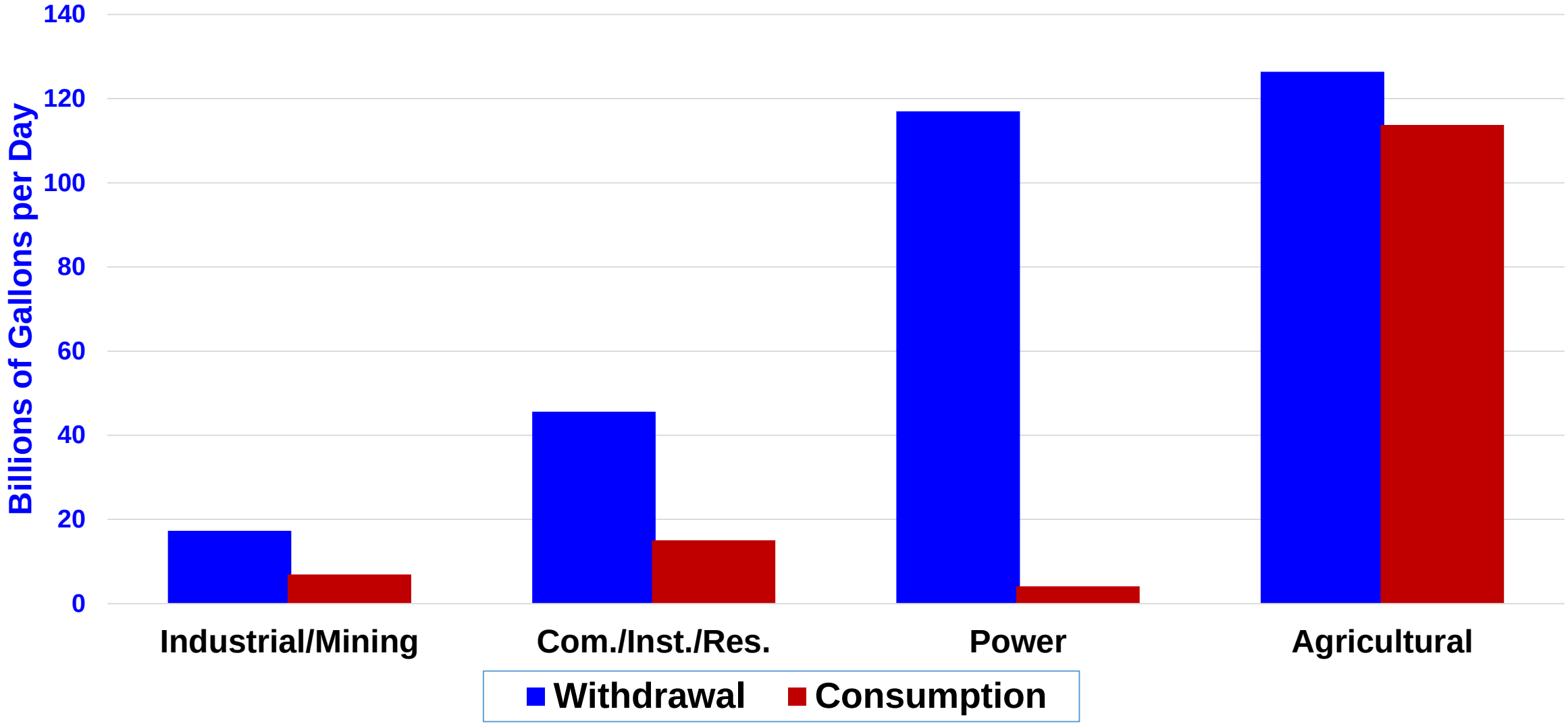
- **Water *Consumption* is the amount of water that is evaporated, included in a product, injected into disposal wells or otherwise not returned in liquid form to a water source.**

- ***Return flows* equal the difference between use and consumption.**

Withdrawal vs. Consumption

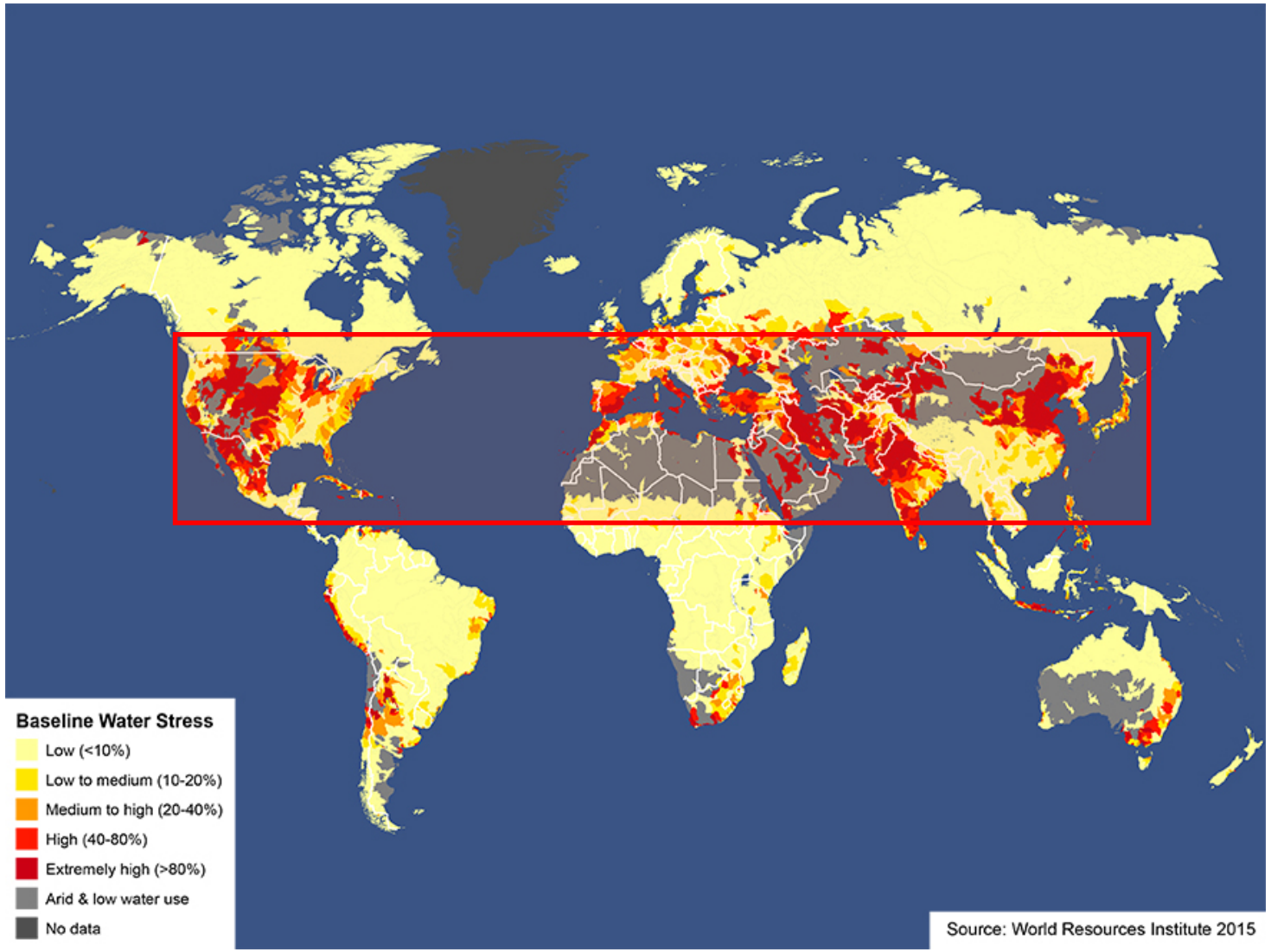
306 billion gallons a day in 2010

USGS and H.W.(Bill) Hoffman & Associates, LLC



Water Stress Index

And the latitude of stress.



Map of United States Showing Cumulative Groundwater Decline

Source: USGS, Konikow, L.F., 2013

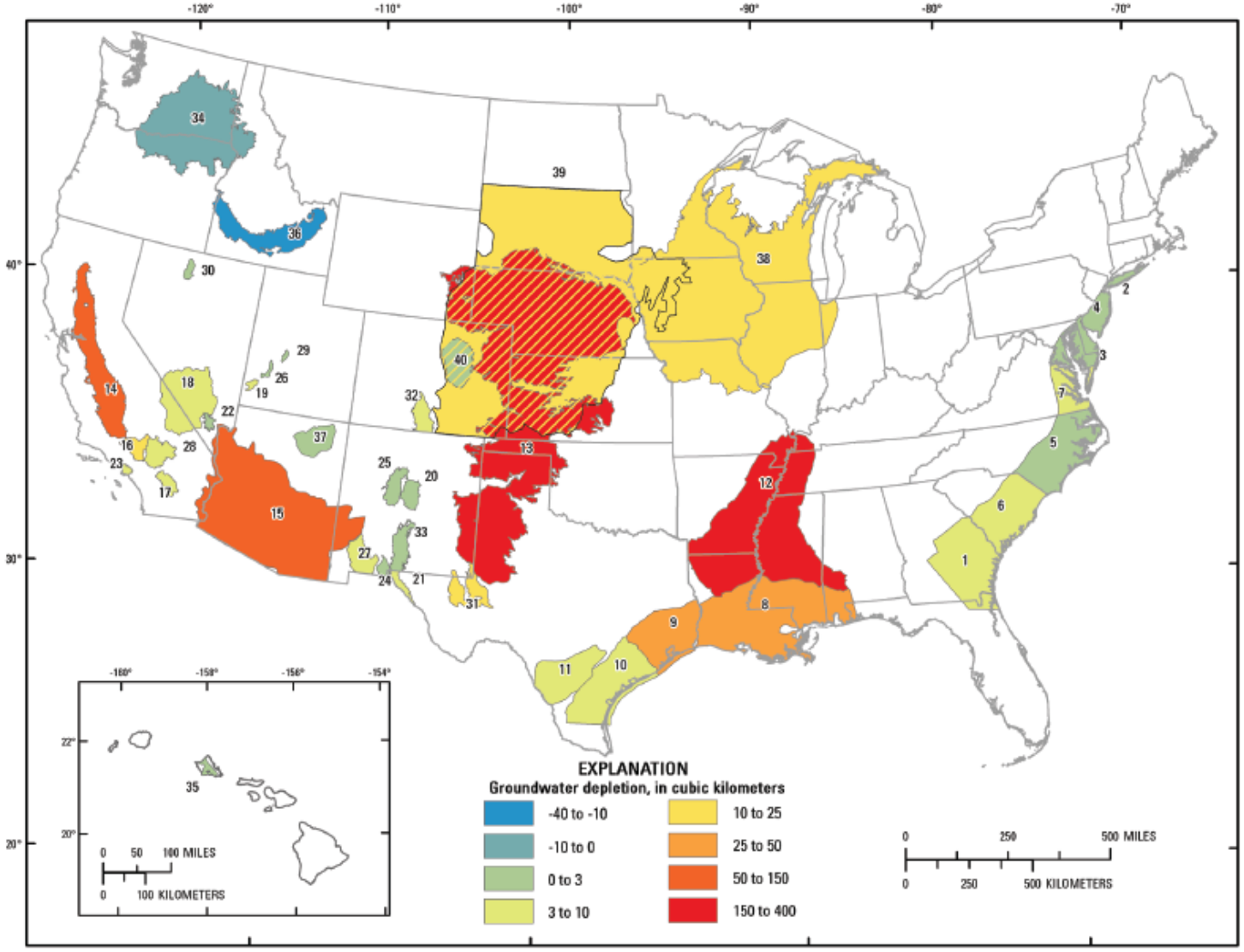


Figure 2. Map of the United States (excluding Alaska) showing cumulative groundwater depletion, 1900 through 2008, in 40 assessed aquifer systems or subareas. Index numbers are defined in table 1. Colors are hatched in the Dakota aquifer (area 39) where the aquifer overlaps with other aquifers having different values of depletion.

Nationally, the age of dam building is nearing the end

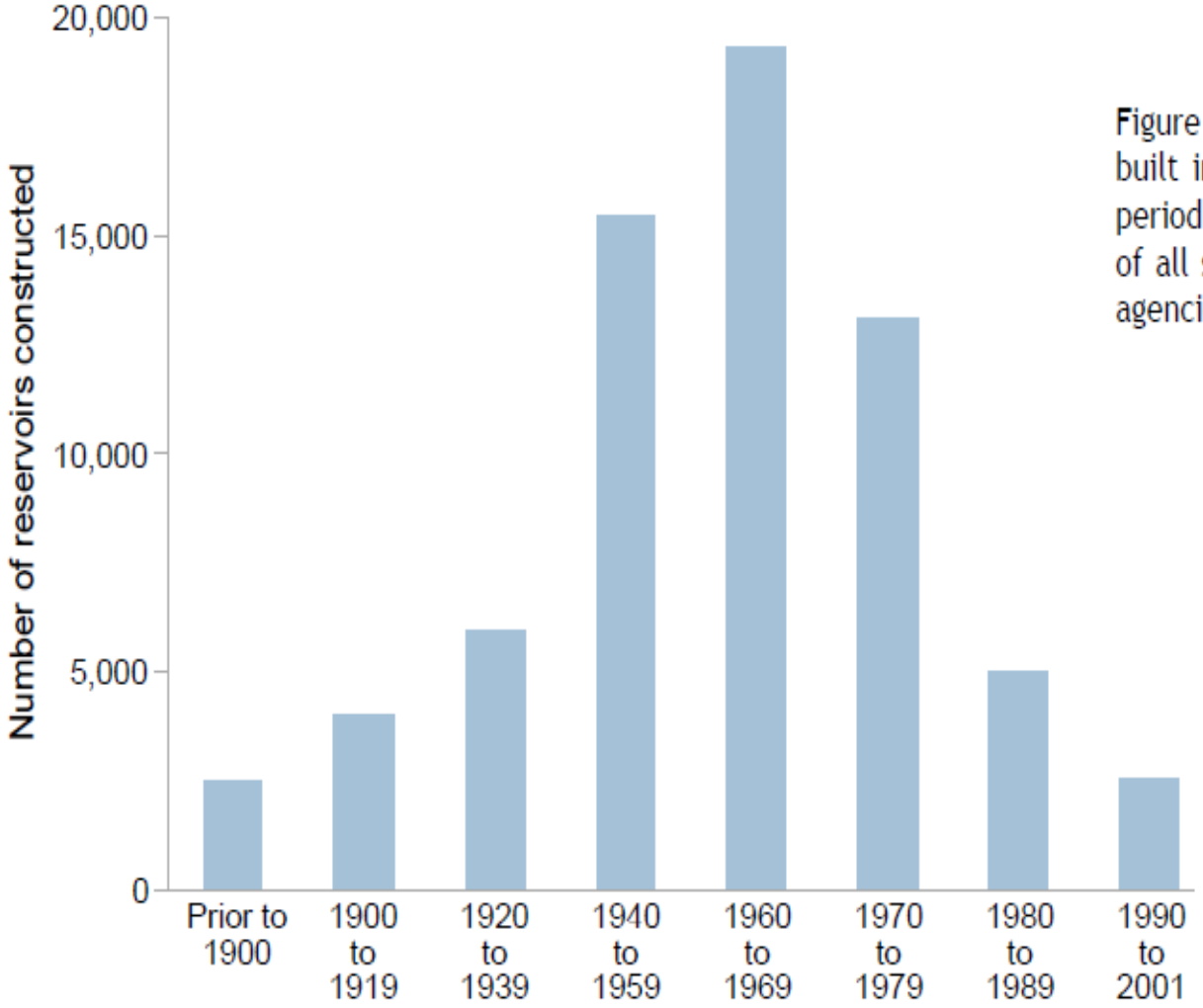


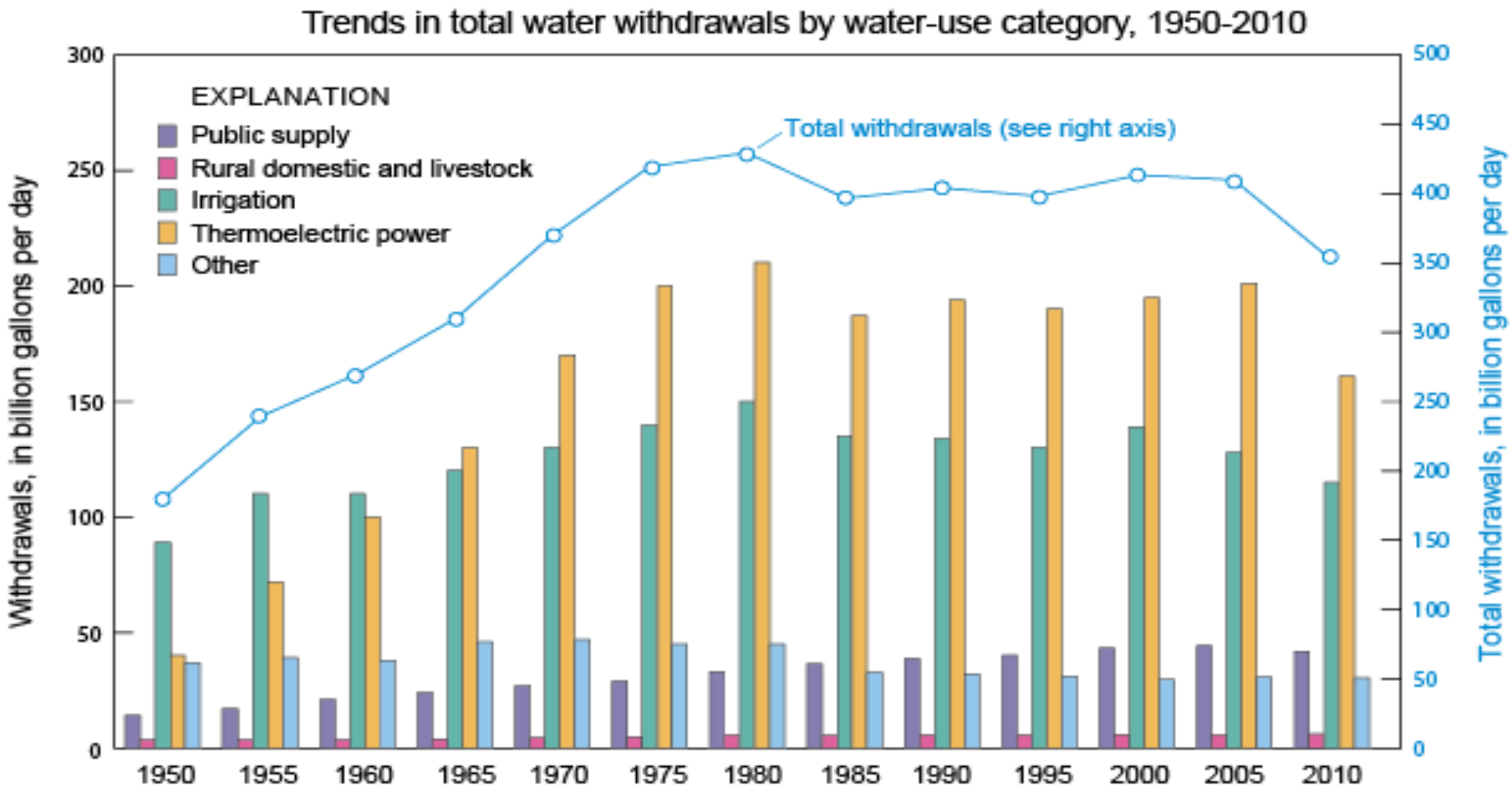
Figure 3.1. The number of reservoirs built in the United States by time period. This figure includes dams of all sizes recorded by regulatory agencies (Gleick, 2000).

Man Made Reservoirs Evaporate ***HUGE*** Volumes of Water Daily

- **Lake Mead – 1 billion gallons per day**
- **Texas reservoirs combined – 7.6 billion gallons of water a day**
- **Gross evaporation across the USA ranges from 30 inches to 140 inches a year – 19 to 87 gallons per square foot of lake surface a year.**

So is Conservation Working?

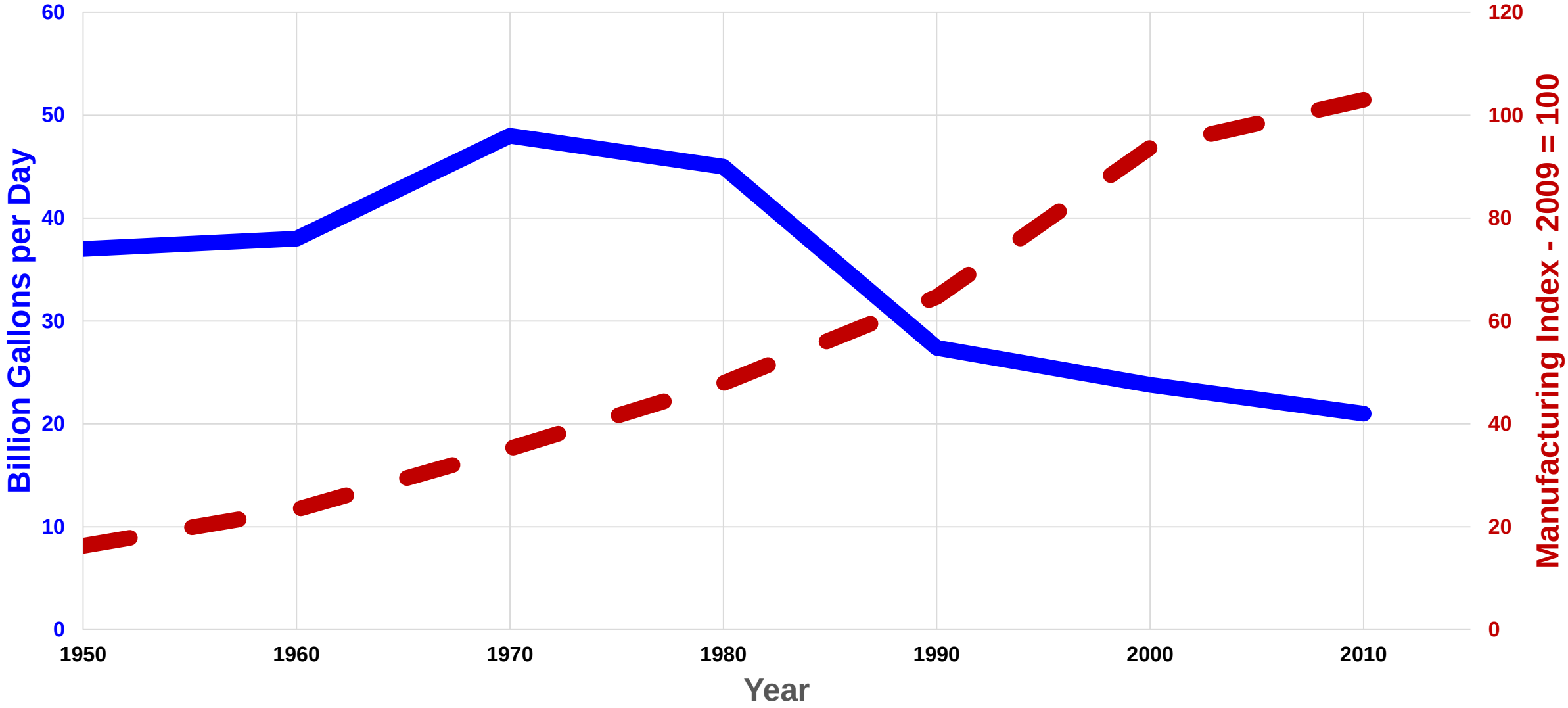
USGS Trends


Trends in total water withdrawals by water-use category, 1950-2010
EXPLANATION
Public supply
Rural domestic and livestock
Irrigation
Thermoelectric power
Other
Total withdrawals (see right axis)
Withdrawals, in billion gallons per day
Total withdrawals, in billion gallons per day
0
50
100
150
200
250
300
0
50
100
150
200
250
300
350
400
450
500
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

Post Clean Water Act of 1972 Impact on Industrial Water Use

Manufacturing Index vs Water Use in USA

Sources: USGS & Dept. of Commerce

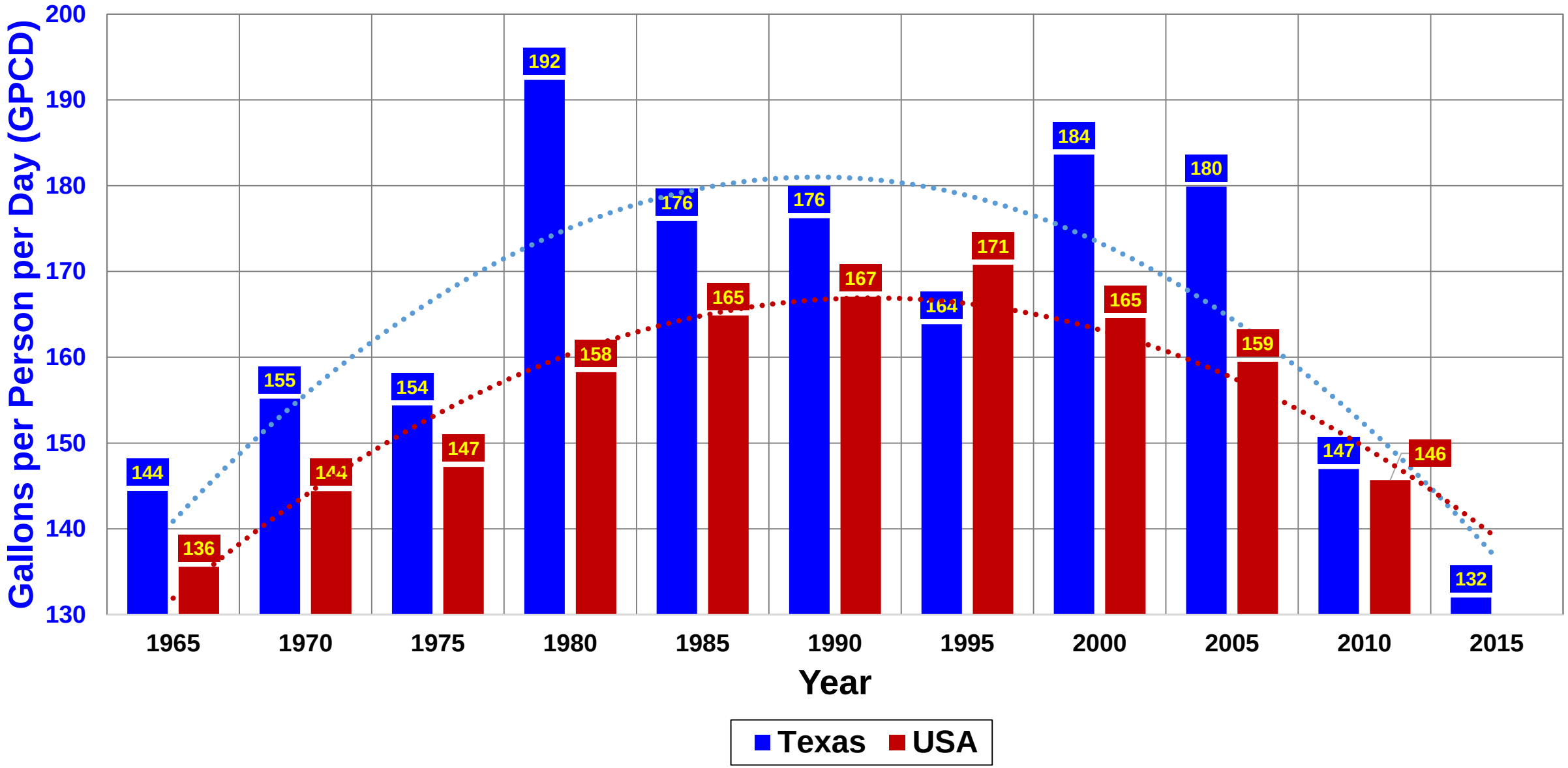


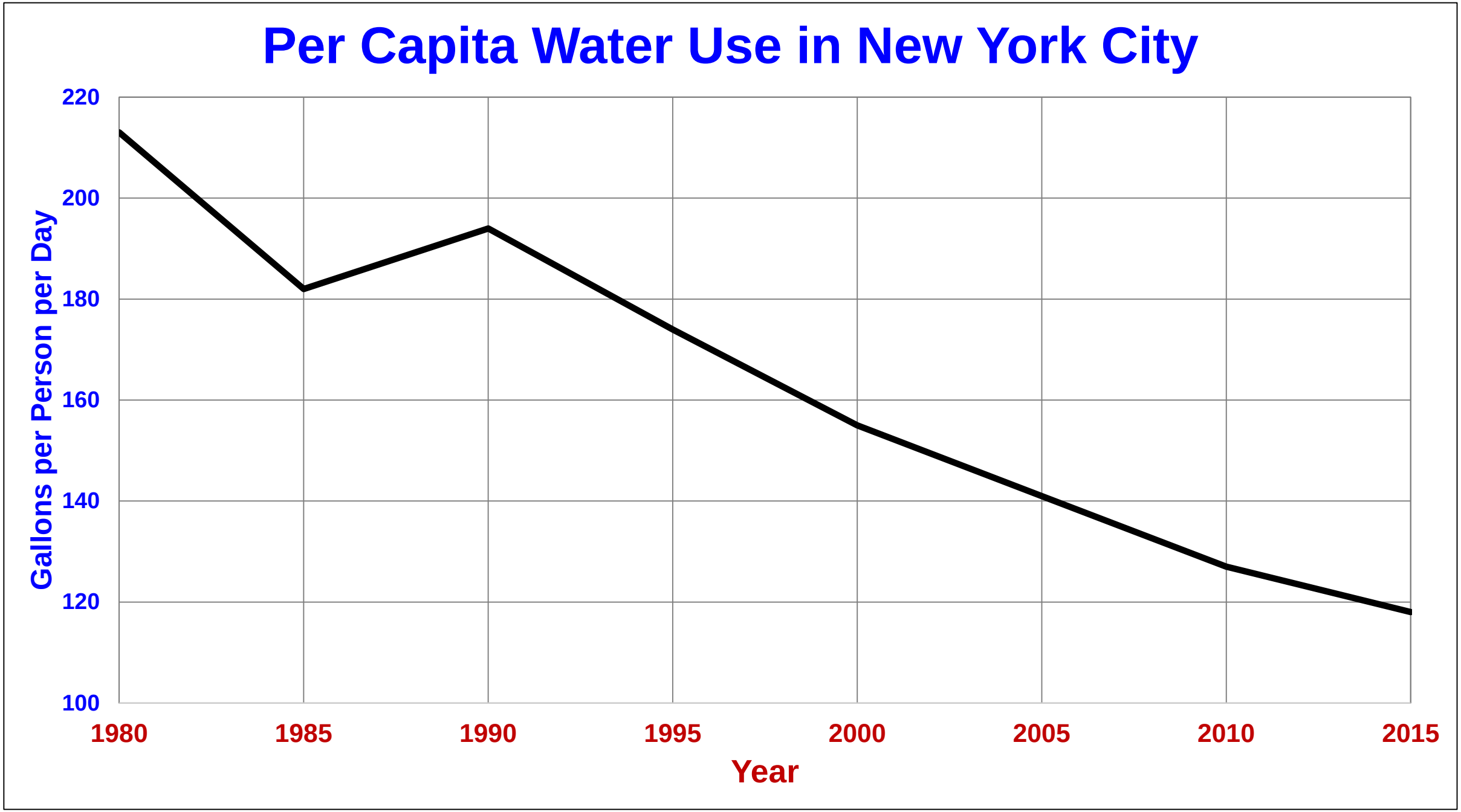
Municipal Per Capita Use After 1993

Note: Current Municipal Use in USA about 45 billion gallons per day (45 BGD)

Per Capita Water Use in USA and Texas

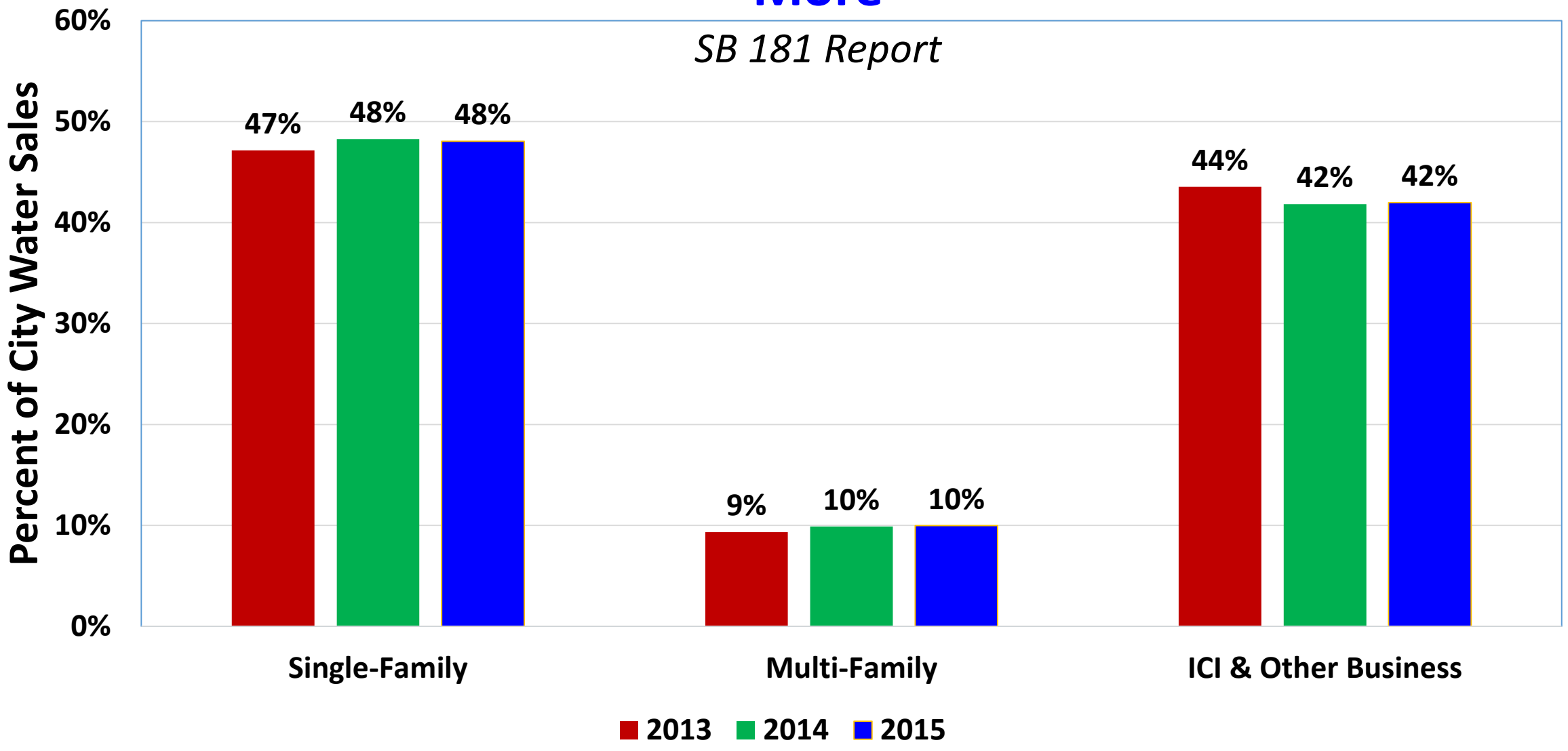
Sources: TWDB and USGS



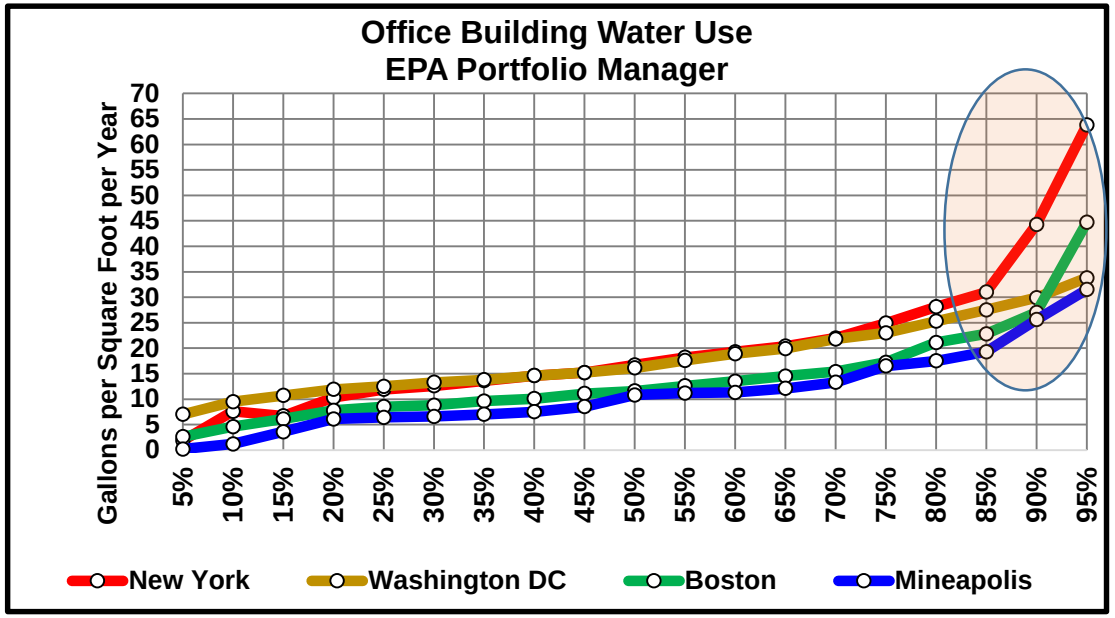

Per Capita Water Use in New York City
Gallons per Person per Day
220
200
180
160
140
120
100
1980
1985
1990
1995
2000
2005
2010
2015
Year

Benchmarking
&
Audits

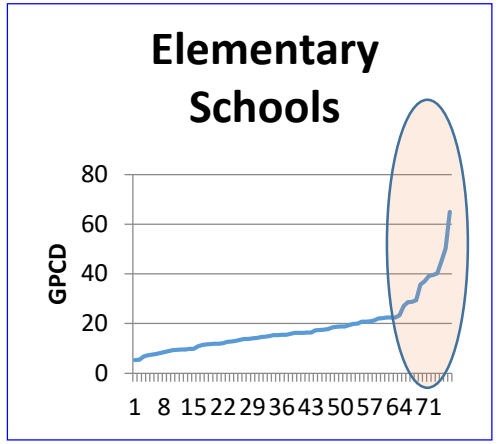
Water Use in Texas Cities of 3,300 Population or More

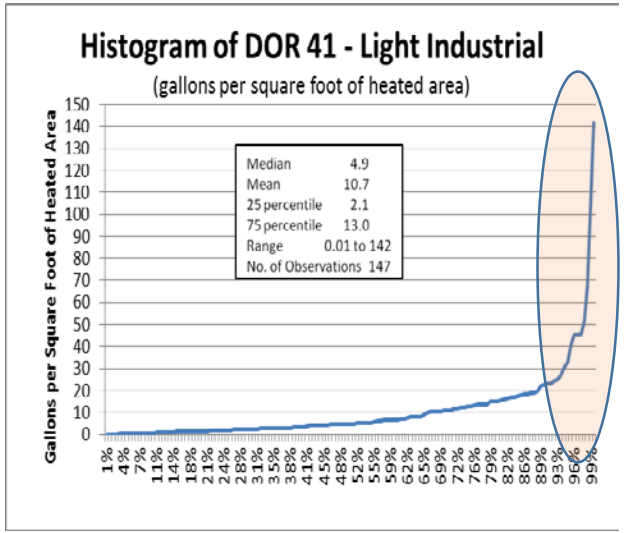


ICI Use - A few skew the results

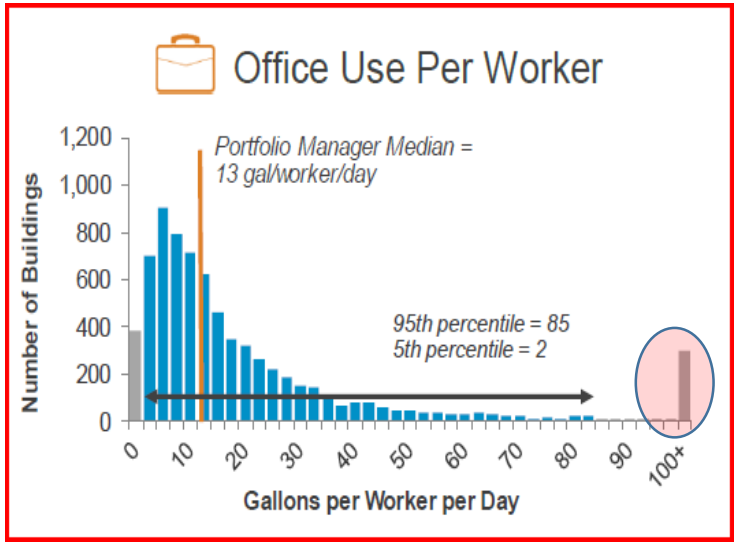


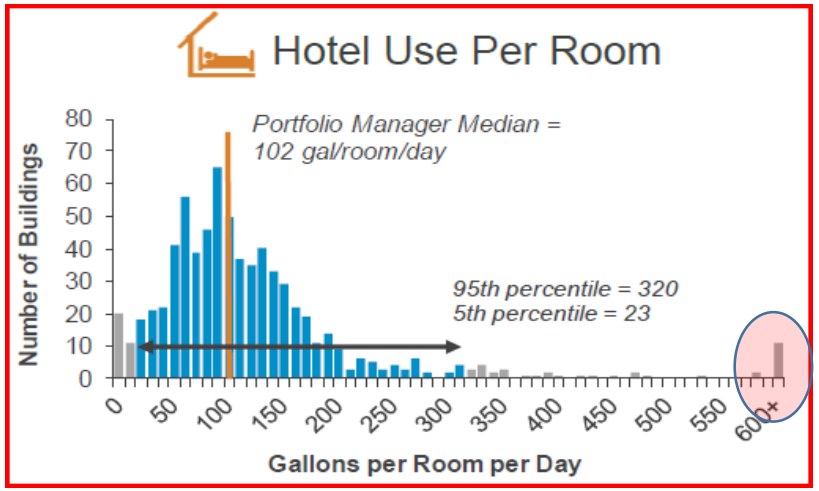
Do You see the same Pattern Here?

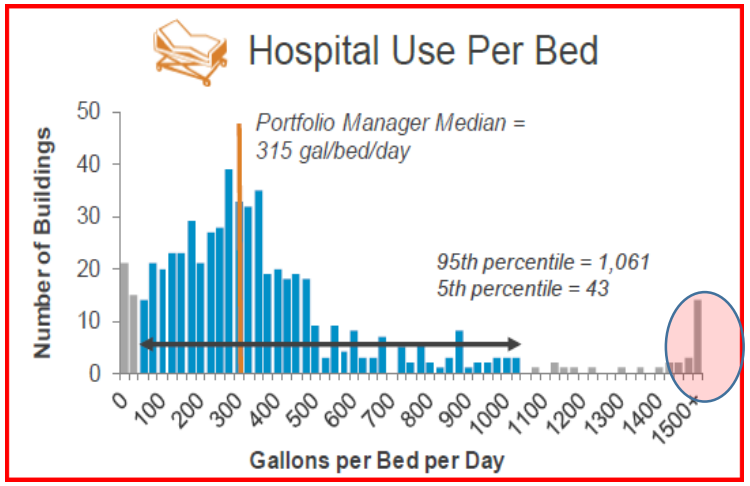




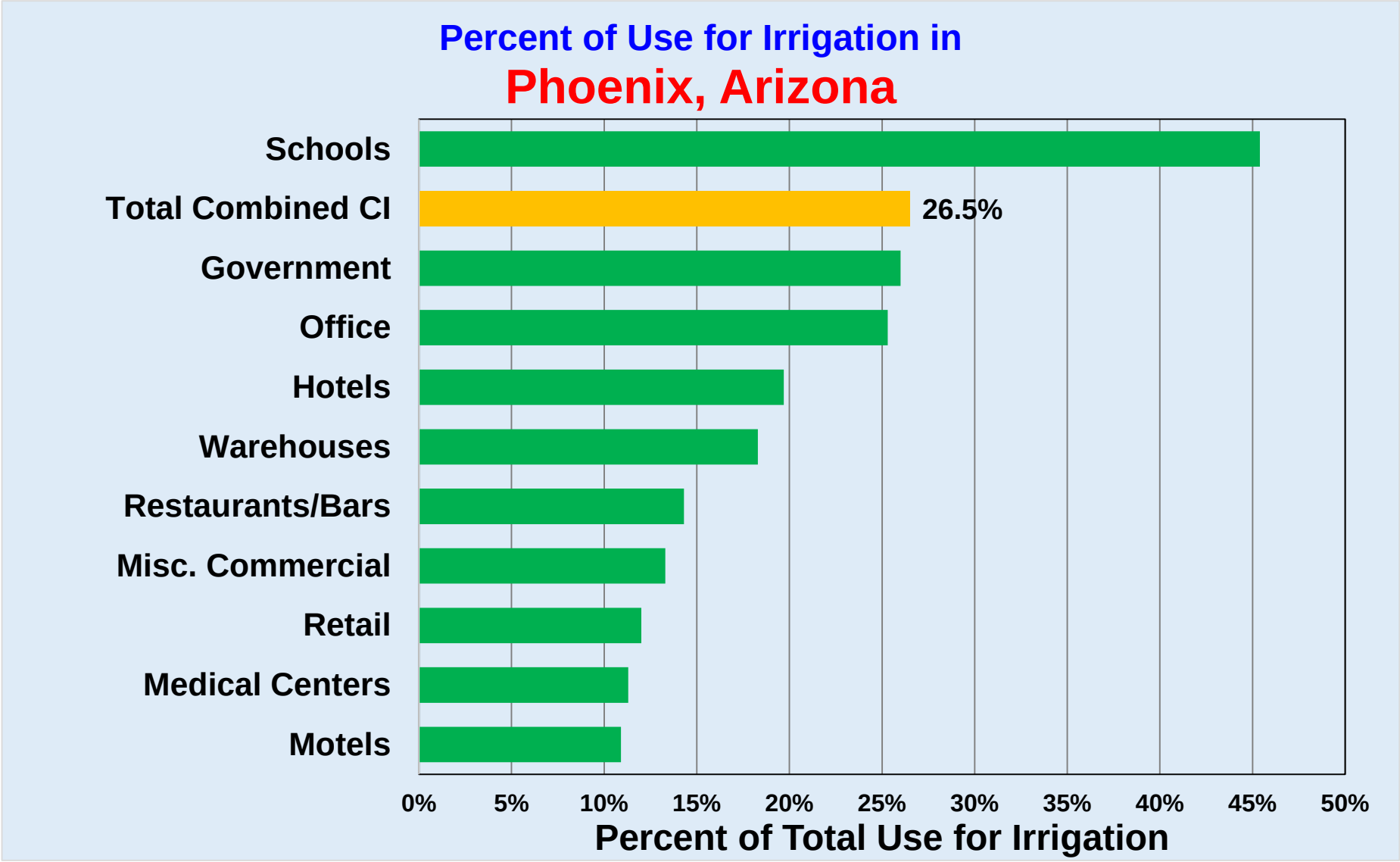
EPA Portfolio Manager Information on Water - 2012







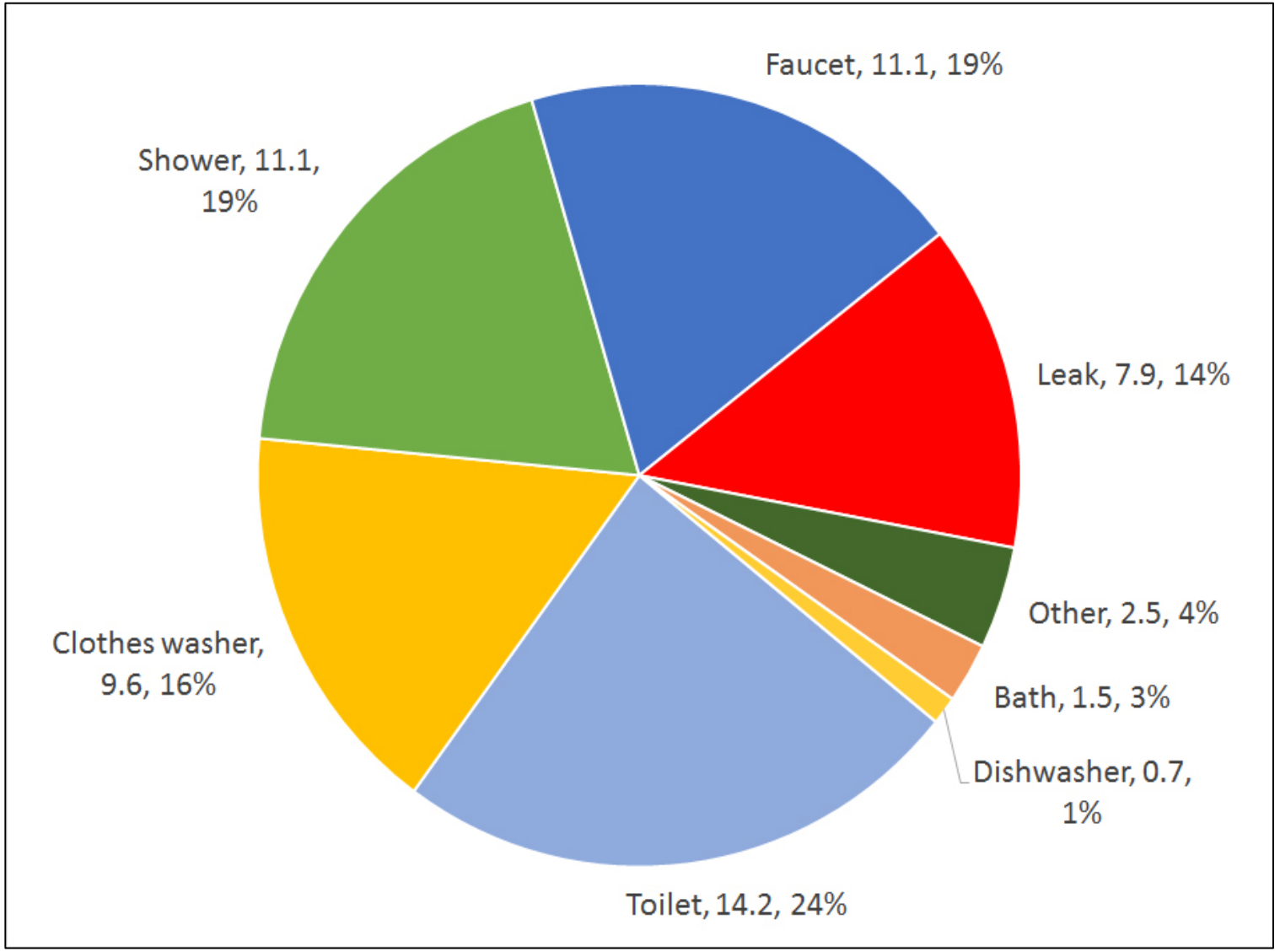
Commercial & Institutional Landscape use from ARID area



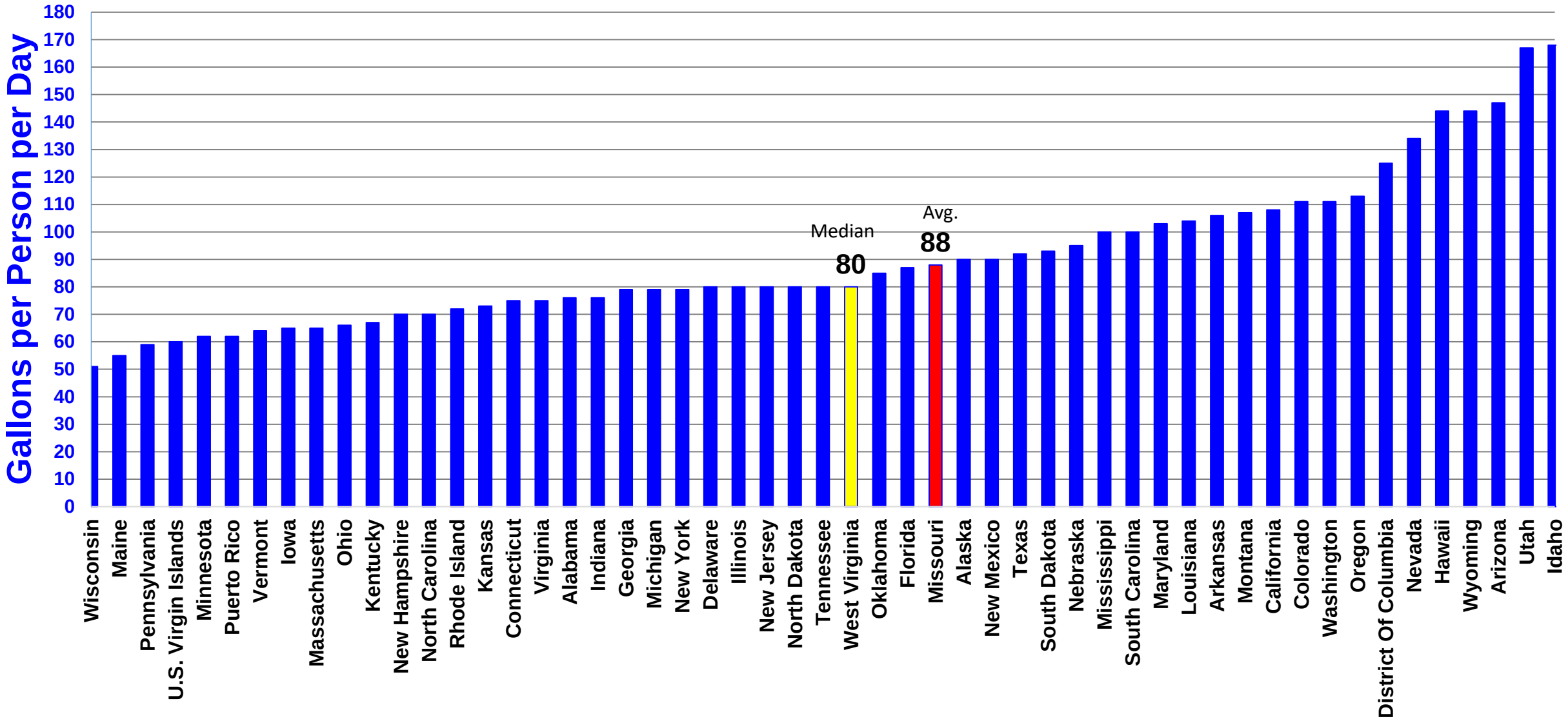
Indoor Water Use Averages

58.6 GPCD

2016 Water Research Foundation Study 4309B

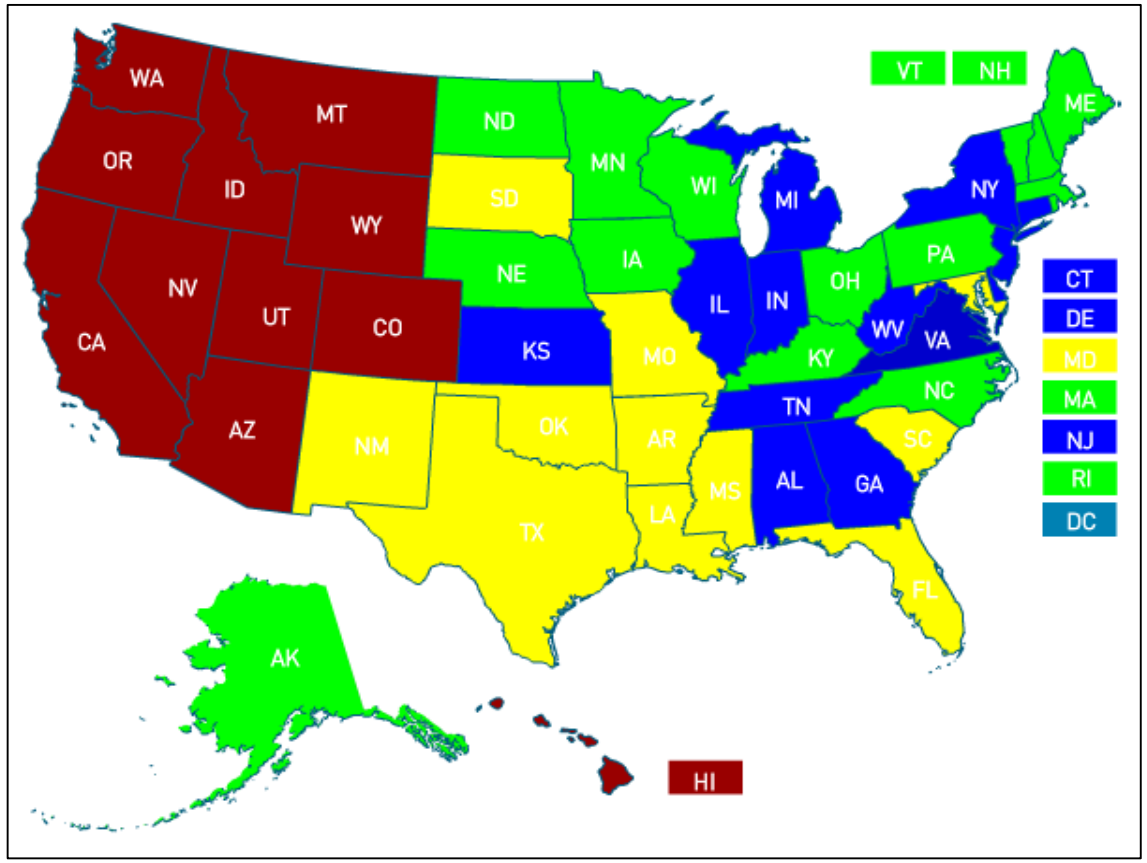


USGS 2010 Per Capita **Domestic (Residential)** Use



Percent of Domestic (residential) Estimated to be for Outdoor Use

Source: USGS Circular 1405 (Tables 1-14)
https://www.google.com/#q=Source:++USGS+Circular+1405+(Tables+1-14)



0-20 % outdoor
20-30 % outdoor
30-45% outdoor
Over 45 % outdoor

An estimate of landscape Water Use In The USA

- **USGS reports average residential per capita use in 88 gpcd. 58.6 gpcd is indoors - 29.4 gpcd is outside.**

- **Assume that commercial and institutional use equals 30% of municipal use of *145 gpcd = 43.5 gpcd***

- **Assume 25% if commercial and institutional use is for landscape = 8.7 gpcd**

- **Total landscape use = *38 gpcd***

IT ***IS***

WORKING!

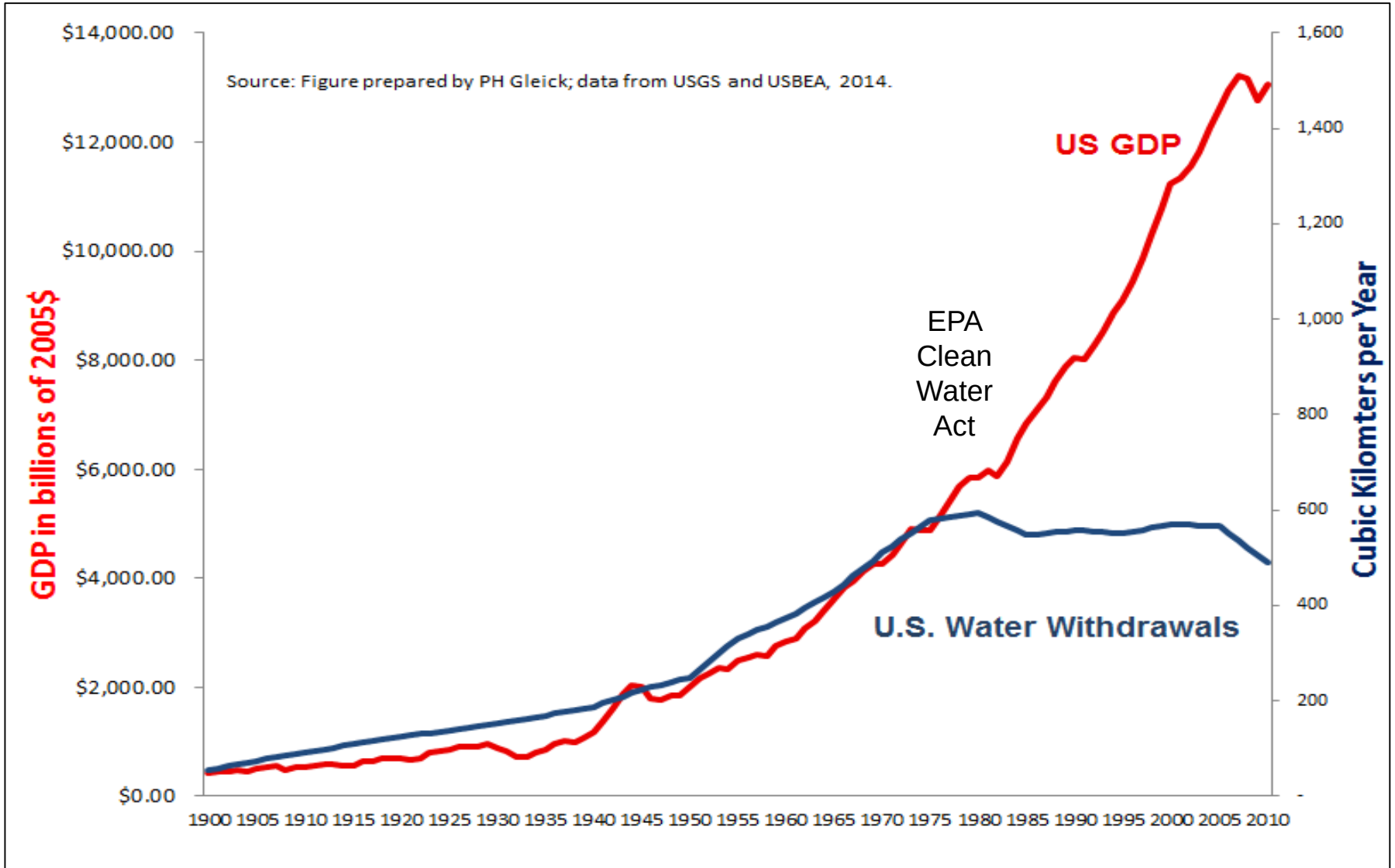
But,

How about the Future?

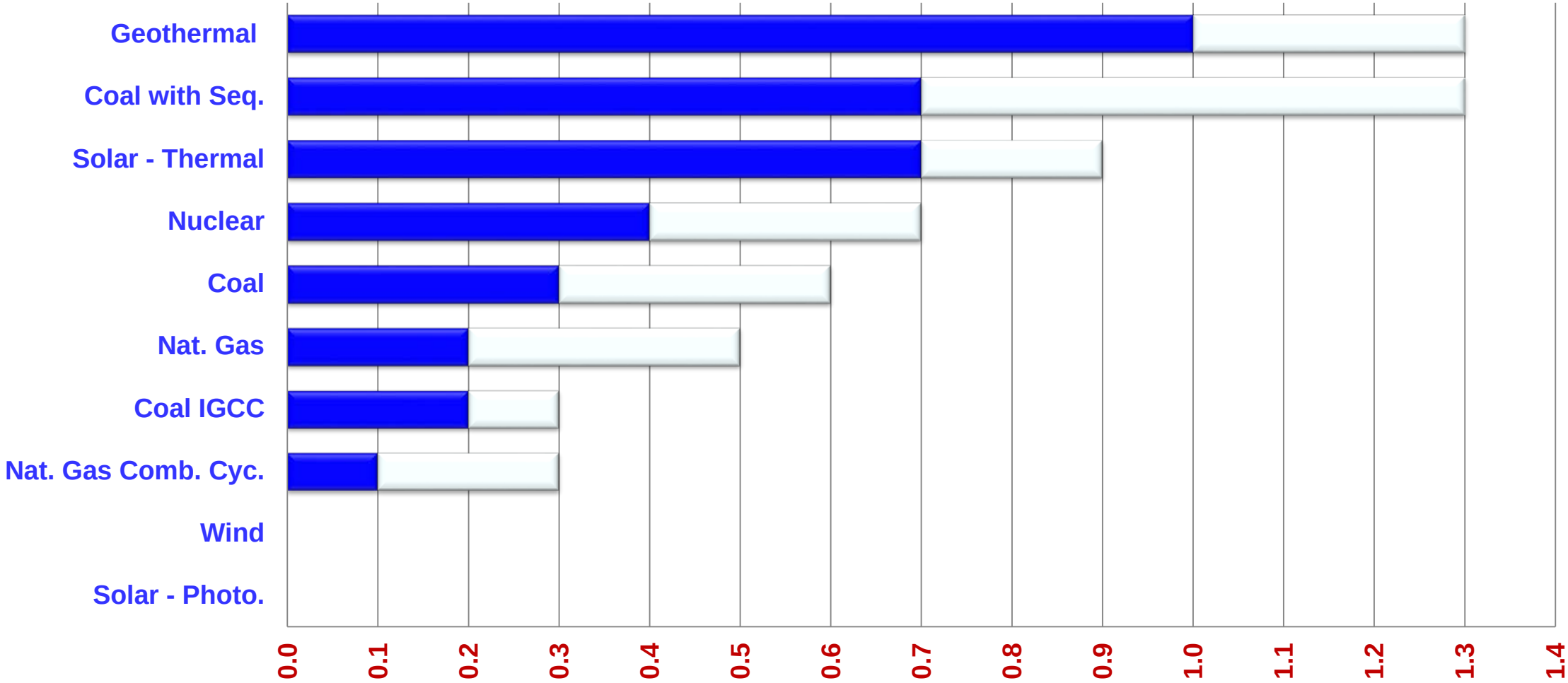
Manufacturing and Power

National Water Use vs. GDP

Source: Peter Glick, Pacific Institute

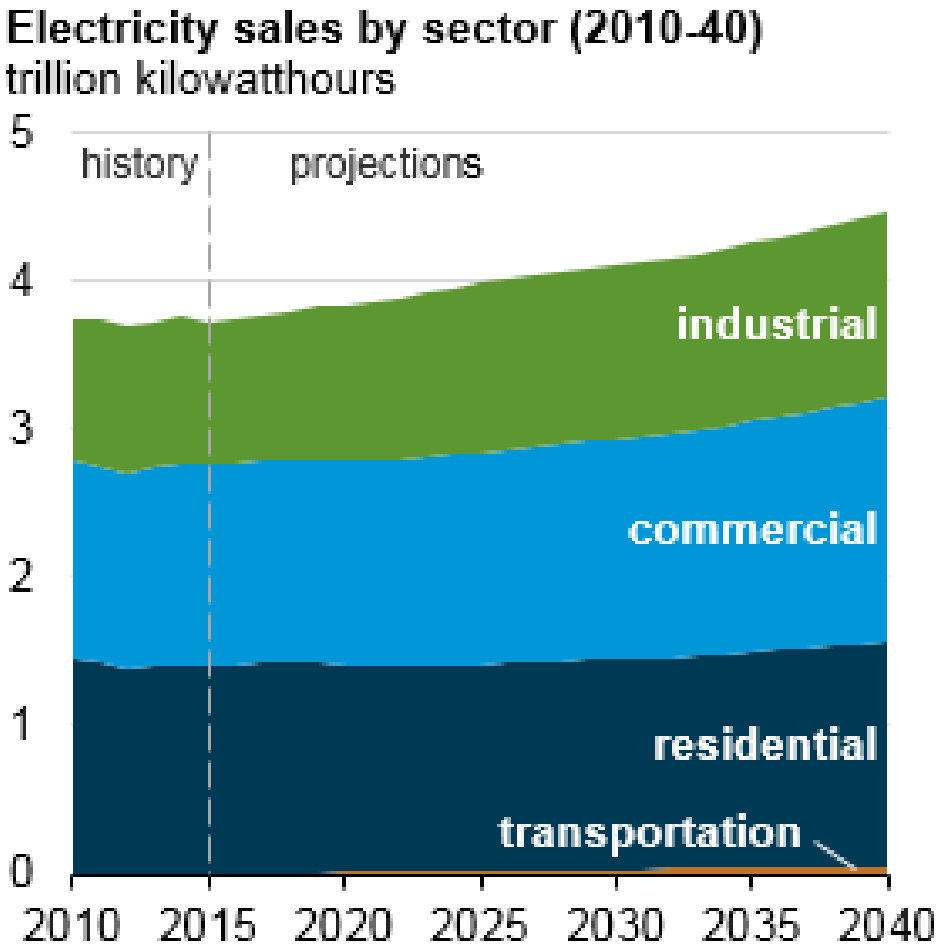


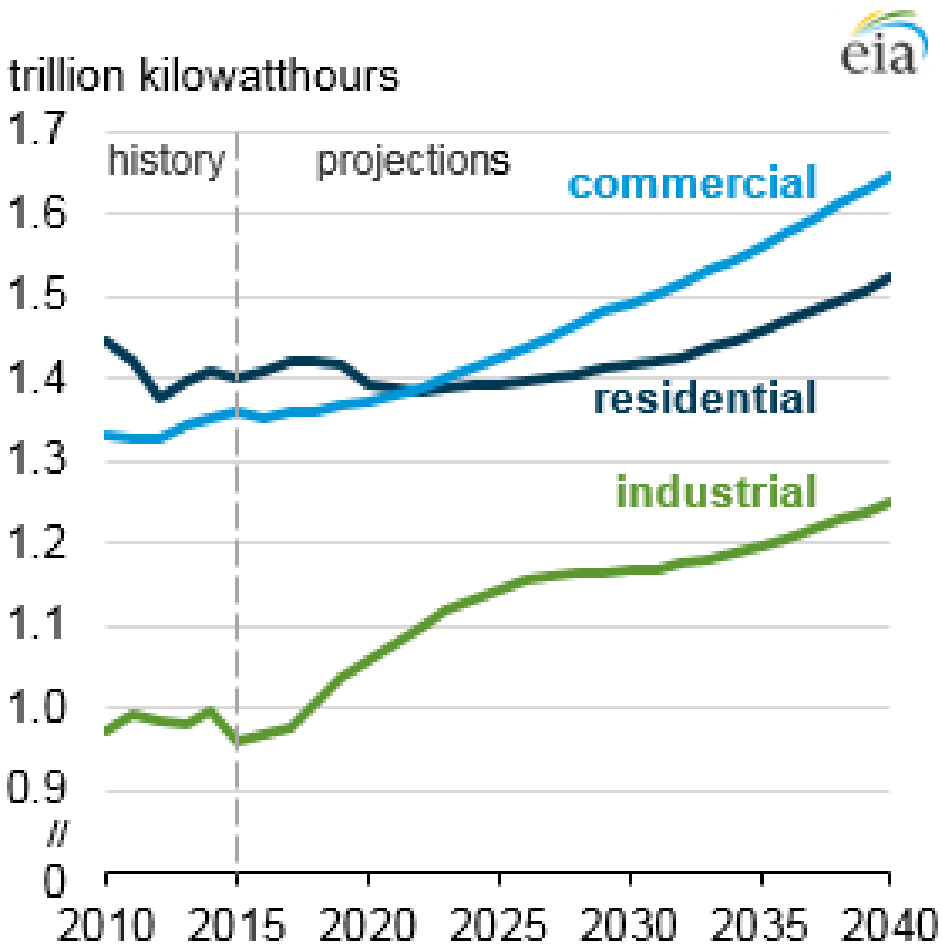
Water Consumed per Kilowatt-hour



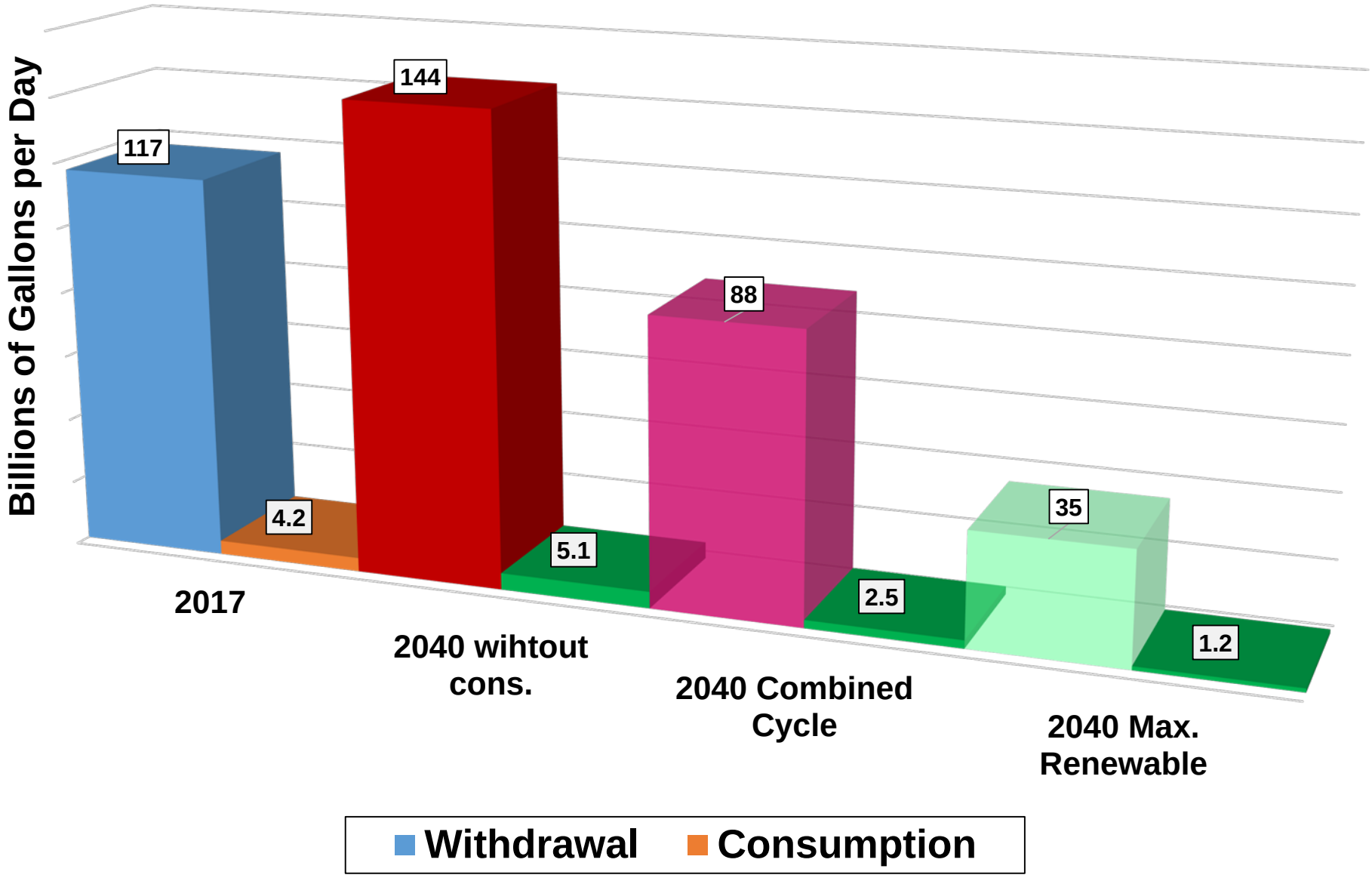
Gallons per Kilowatt Hour

Projected Electricity Use in USA





US Electric Power Withdrawal & Consumption
Billions of Gallons per Day



Residential End Use Study

Aquacraft, Inc. – WRF Report 4309B

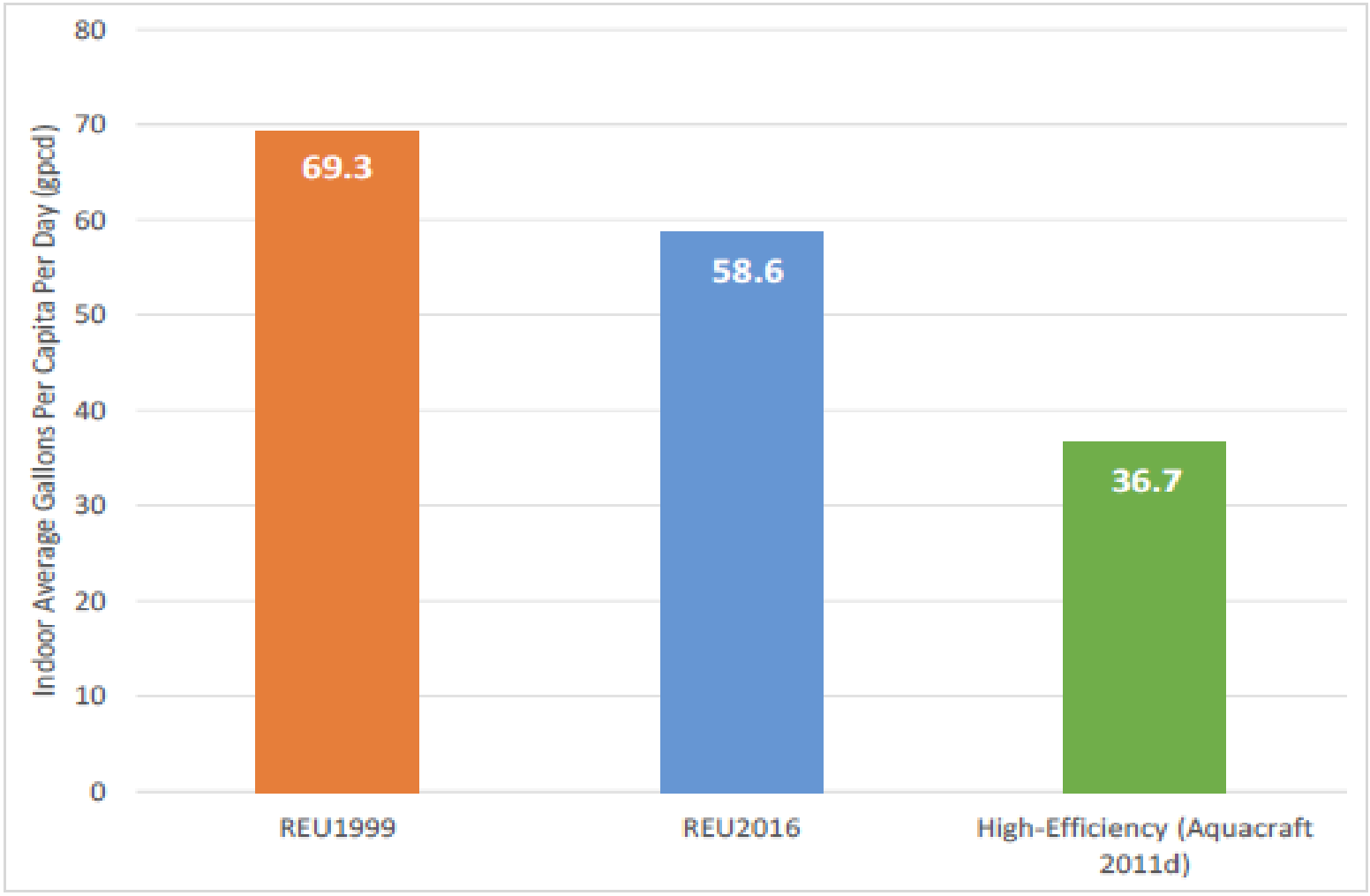
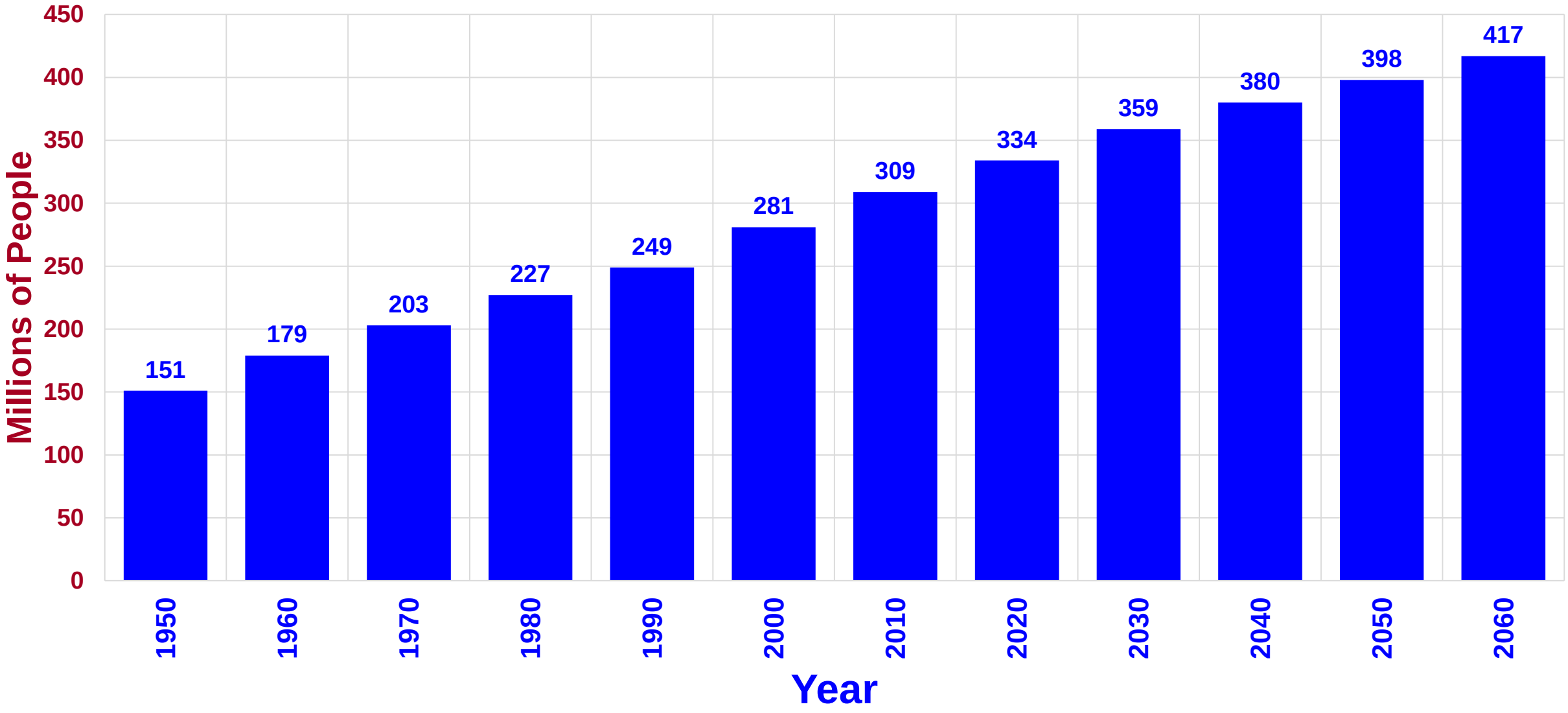


Figure ES.6 Indoor average gallons per capita per day, REU1999, REU2016, High Efficiency Studies

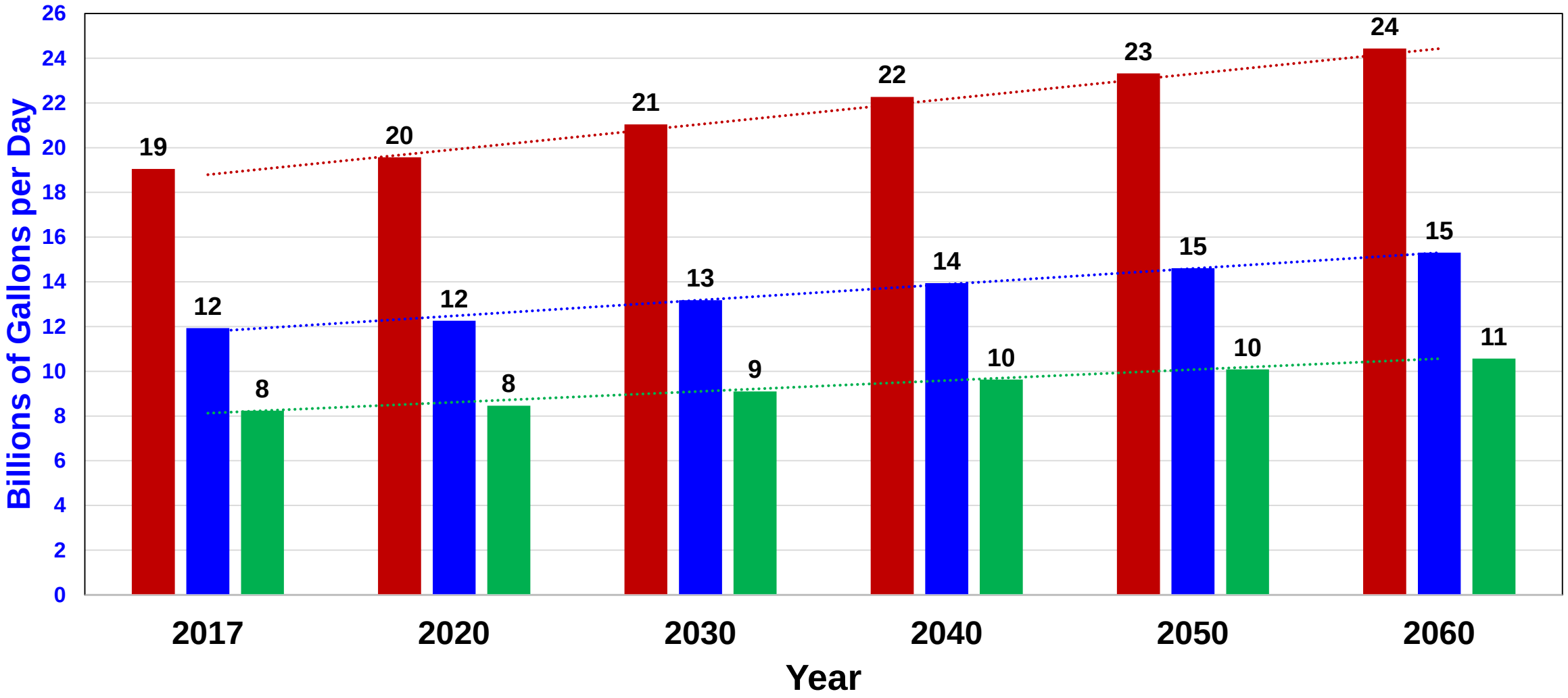
Population of the United States

2017 population = 325 million



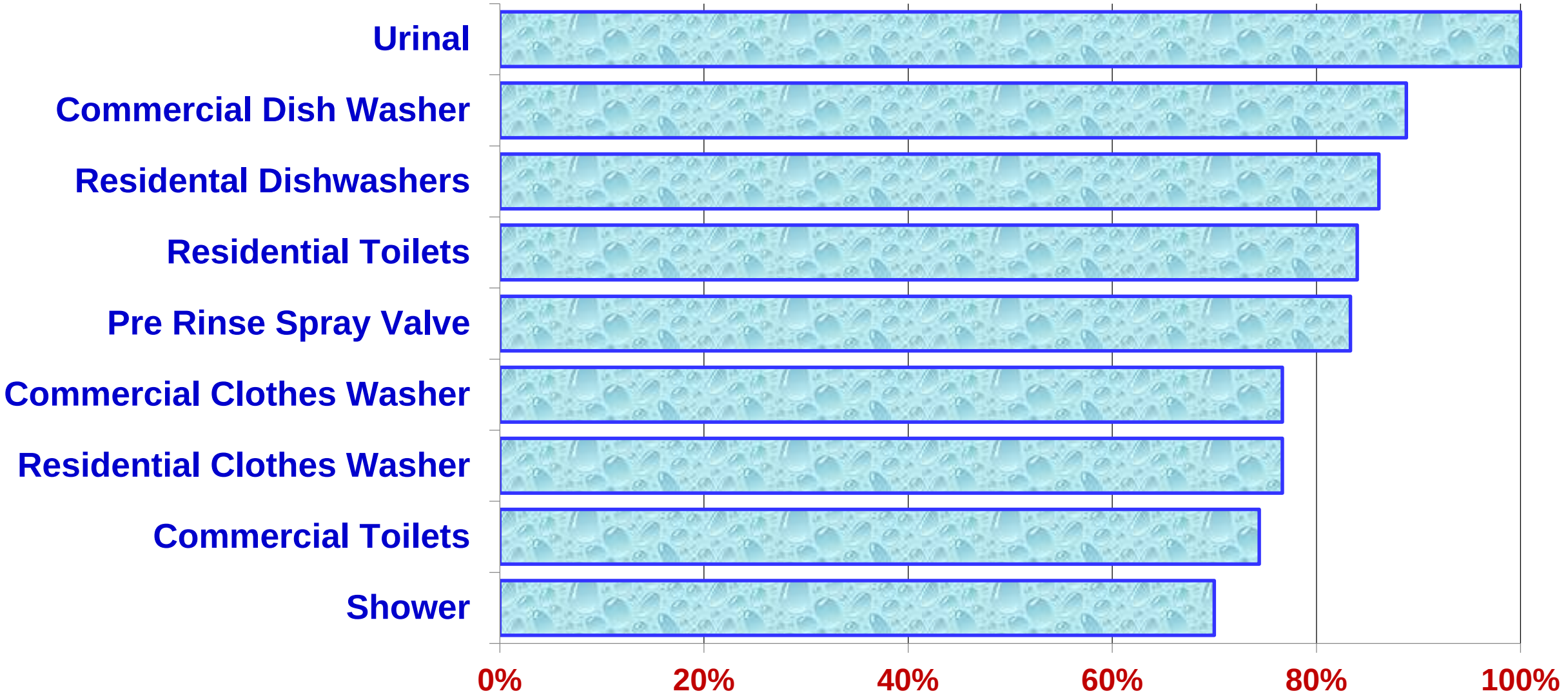
Indoor Residential Use in USA

Aquacraft & H.W (Bill) Hoffman & Associates, LLC



Reduction in Water Use Since 1980

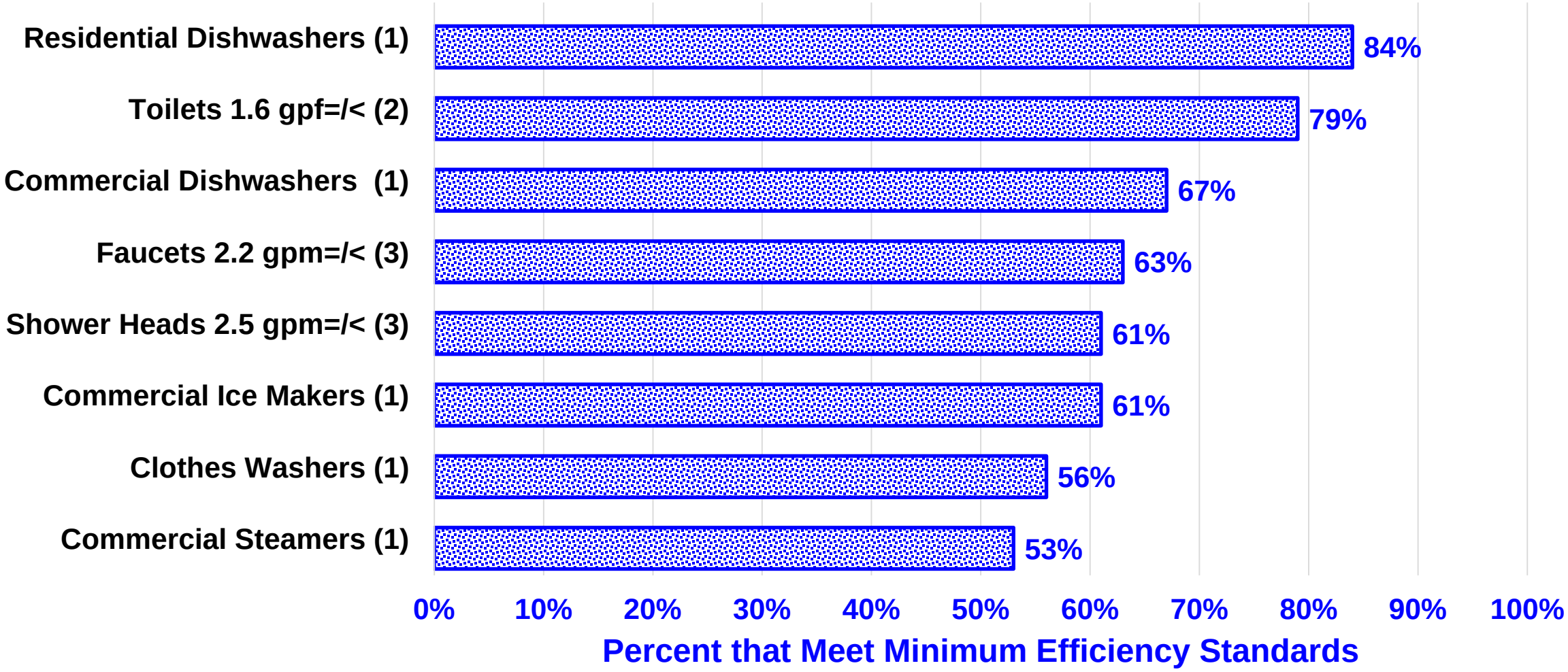
After John Koeller & Bill Hoffman



Percent Reduction in Use for *Best in Class*

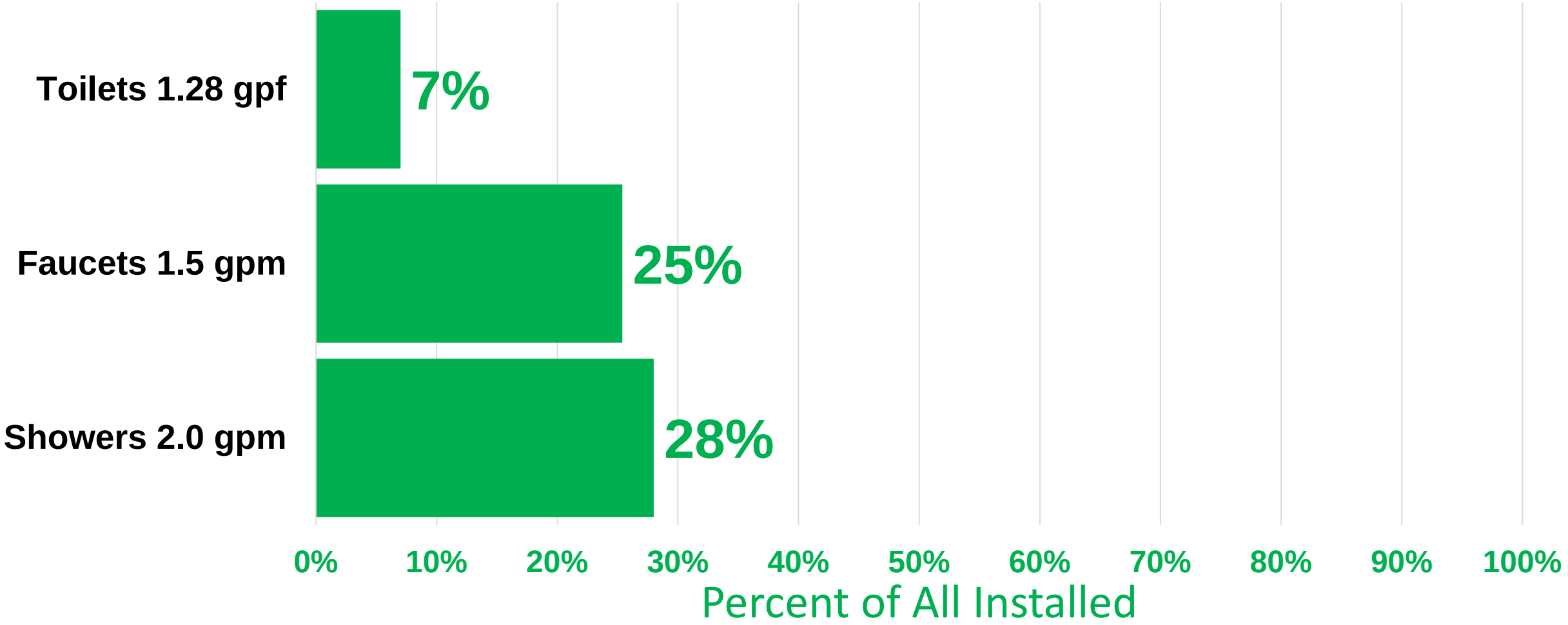
Market Penetration of *Minimally Acceptable* Water Saving Fixtures and Appliances

(1) Energy Star Market Penetration Study - 2015
(2) US Market Penetration Of WaterSense Shower Heads, Lavatory Faucets And Toilets - 2015
(3) A Saturation Study of Non-Efficient



WaterSense Residential Fixture Market Penetration as of 2015

We still have a long way to go!



Hey, I don’t make this stuff up!

LEAKS

- **According to EPA, 15% of water leaks from the distribution system!**
- **Home leaks = 14% (REUS 2016)**
- **Multi-family even higher according to many professionals and commercial properties of all types have leaks.**
- **At least *one of every four gallons* put into the system is lost through LEAKS!**
- ***In other words, if gpcd = 145 gallons per person per day, leak loss equals 36.3 gpcd = 11.9 BGD***

Here is a visual to keep in mind!

One in four lost to leaks!

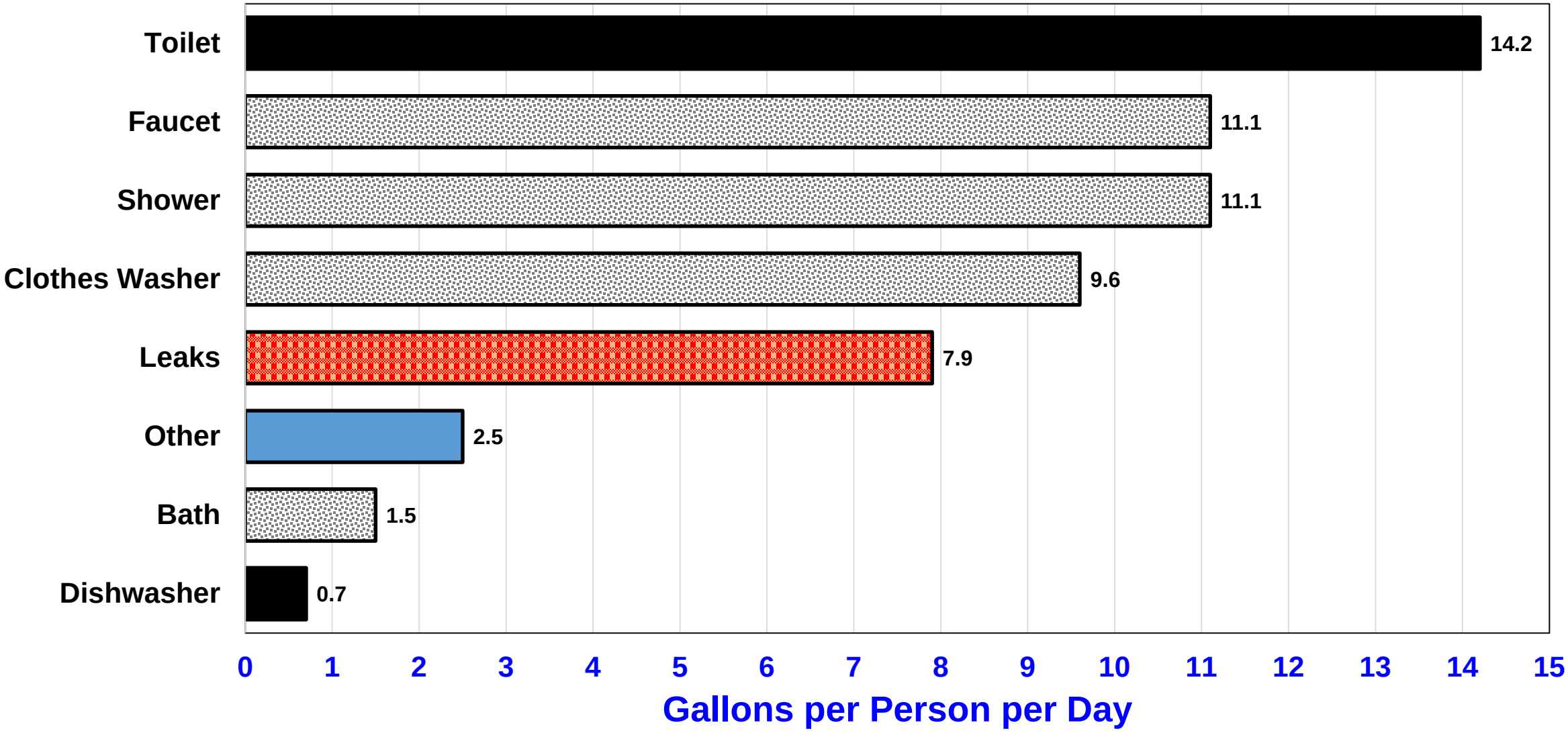
Reuse

- ***Good News and Bad News*** **– In the future we will all drink recycled water. The bad news is there may not be enough to go around!**
- **Over half of municipal use is returned.**
- **On-site reuse is growing (Tokyo, San Francisco, Austin, San Antonio).**
- **The volume available with population???**
- ***Don't forget that many application of reuse are consumptive – reduce withdrawal but not consumption*.**

Municipal wastewater discharge in the 20 - 30 BGD range.

In Home Use
Black, Gray, & Other GPCD

Based on 2016 Residential End Use Study



The Dollar Side

Consumer Price Index for Utilities

http://www.circleofblue.org/waterpricing/

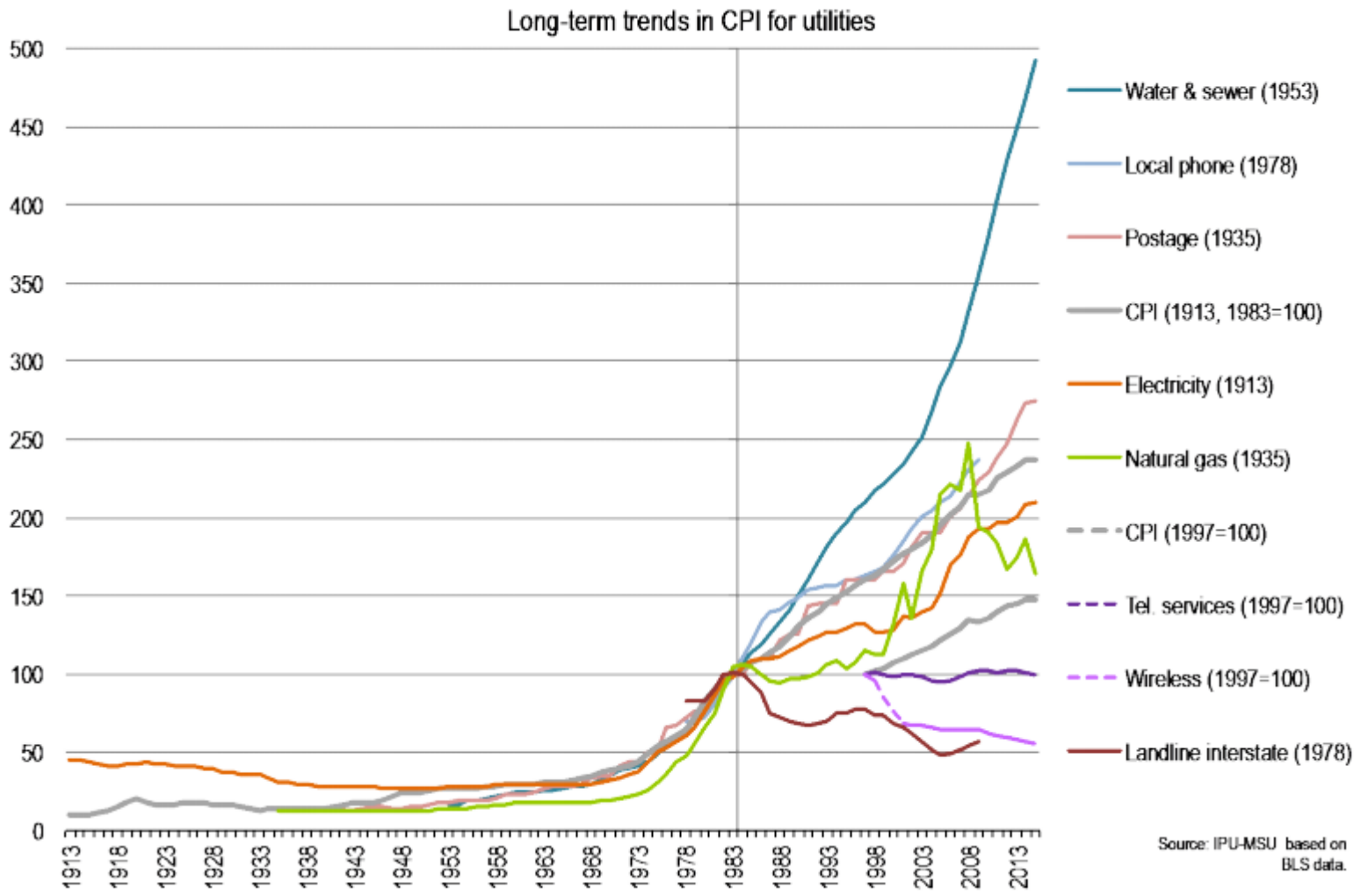
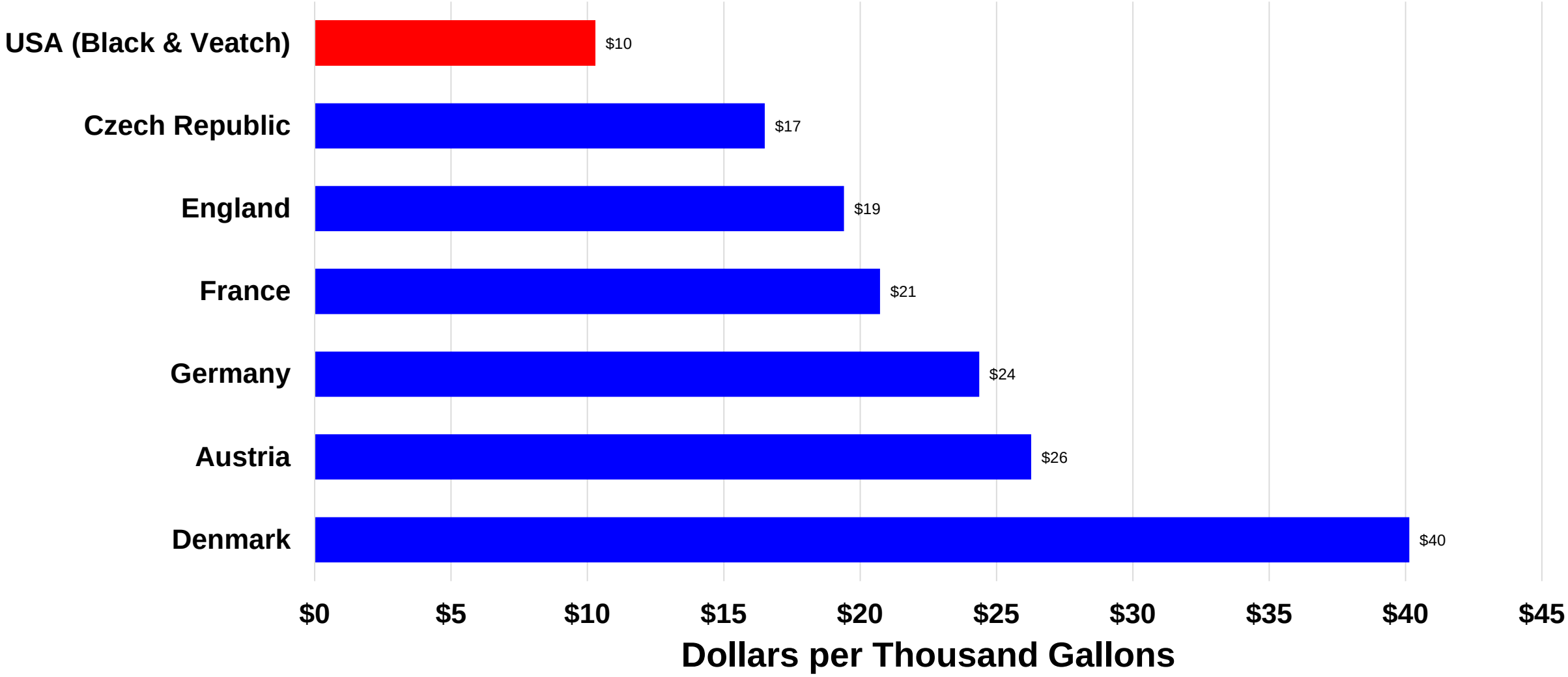


Exhibit 1. Long-term trends in the Consumer Price Index for utilities (1913-2015). The index is set to 100 for 1982-1984 except for telephone and wireless services, where the index is set to 100 for 1997. Year (*) indicates start of series.

Average Residential Water and Sewer Rates in European Countries Compared to USA in 2013

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/mana

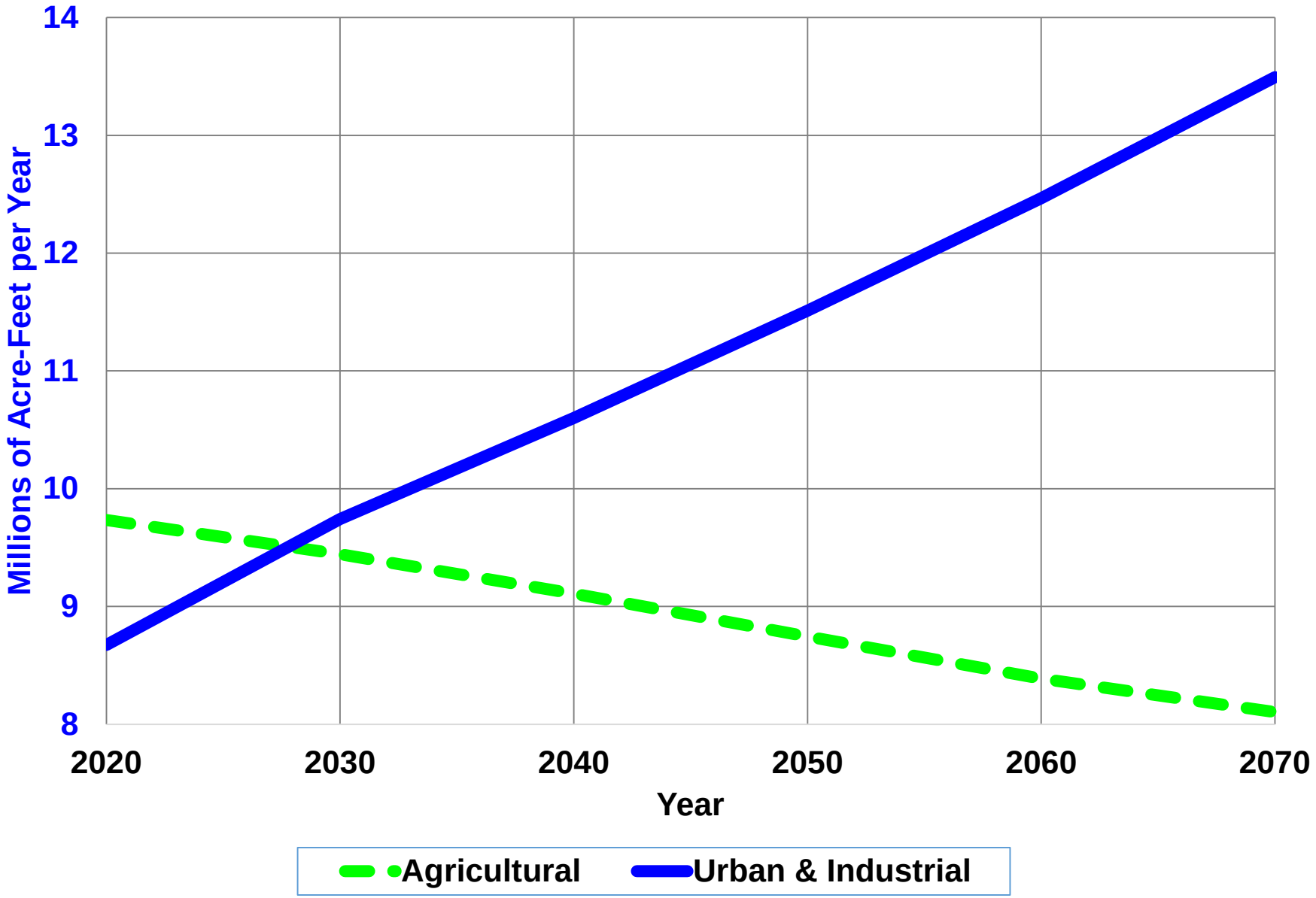


The Cost of One Toilet Flush

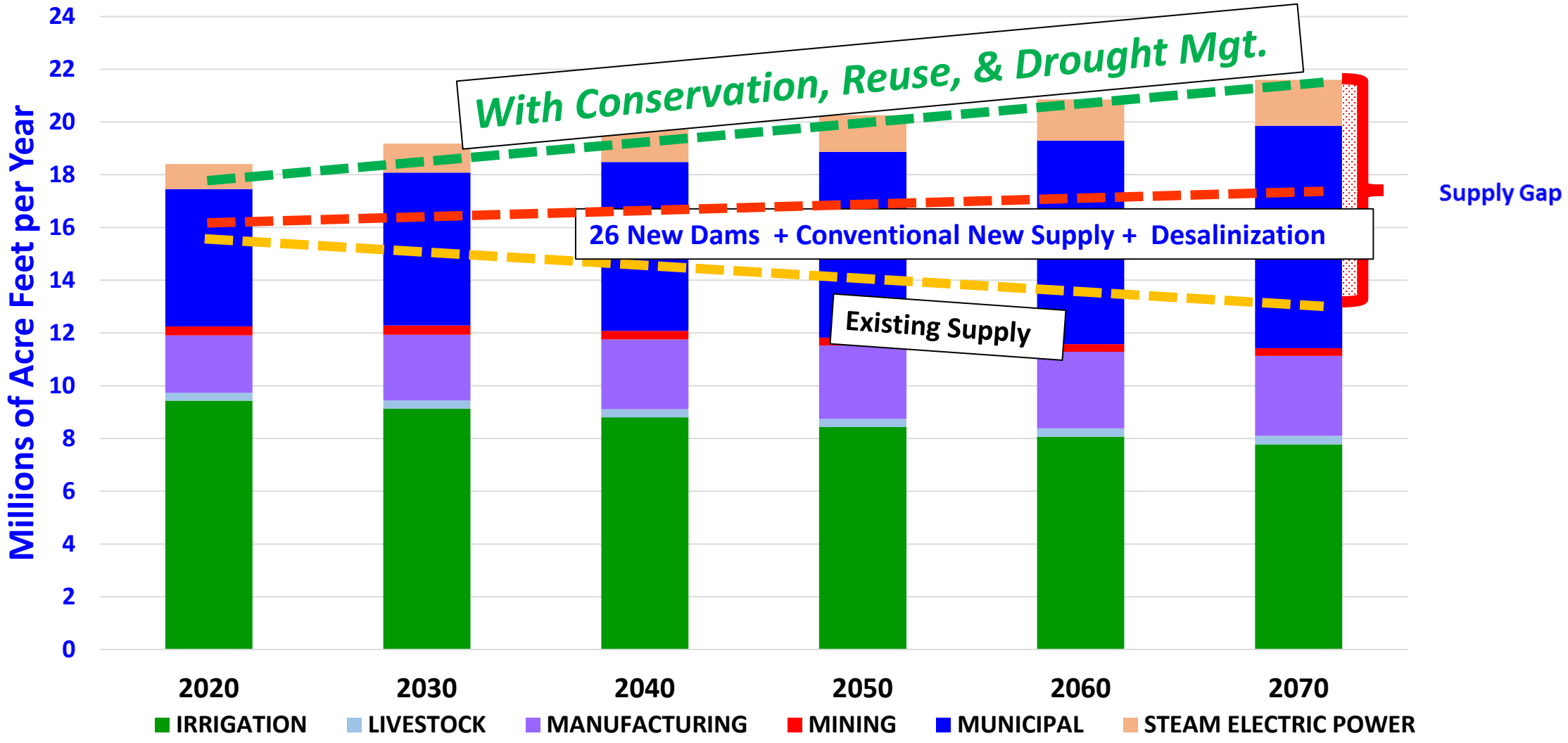
Cost to Flush a Toilet at Current Inflation Rate of 5.85%		
Gallons per Flush	Cents per Flush in 2017	Cents per Flush in 2037
5	5.6	17.6
3.5	3.9	12.3
1.6	1.8	5.6
1.28	1.4	4.5

The Texas Example

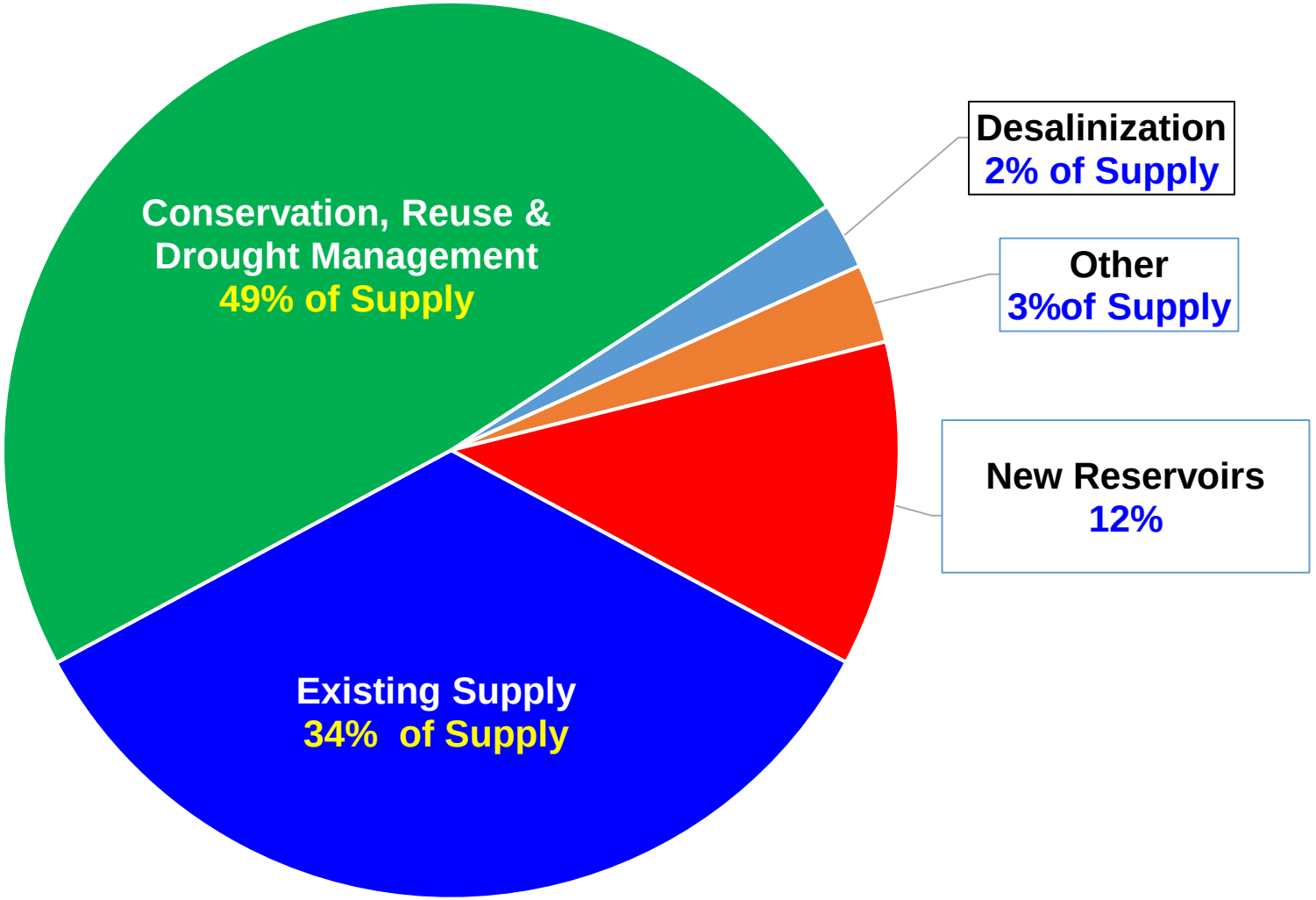
Future Texas Water Use
2017 Texas Water Plan



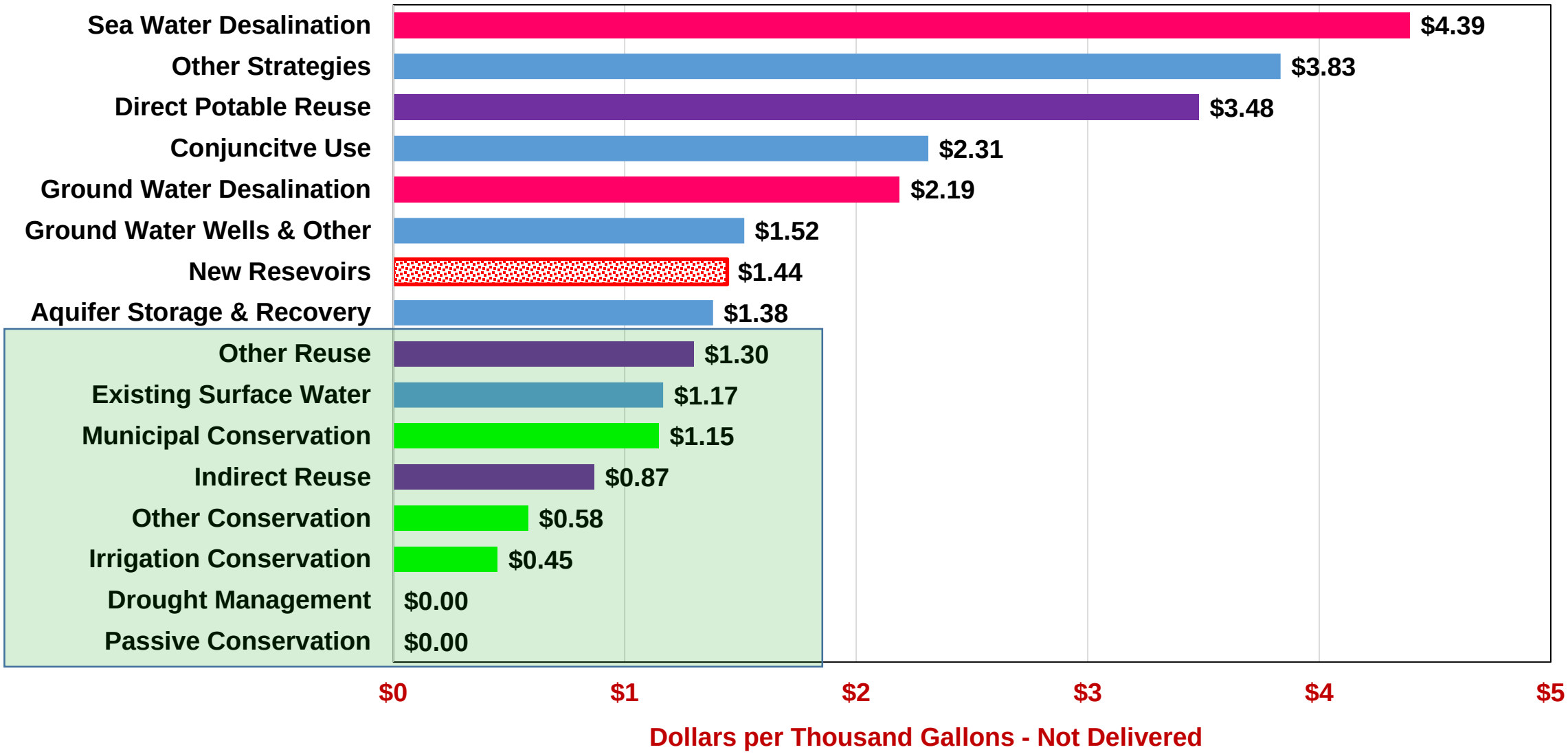
Texas Water Supply & Demand Projections
With Conservation, Reuse & Drought Mgt.



Where Future Water Will Come From And its Capital Cost in Texas in 2070

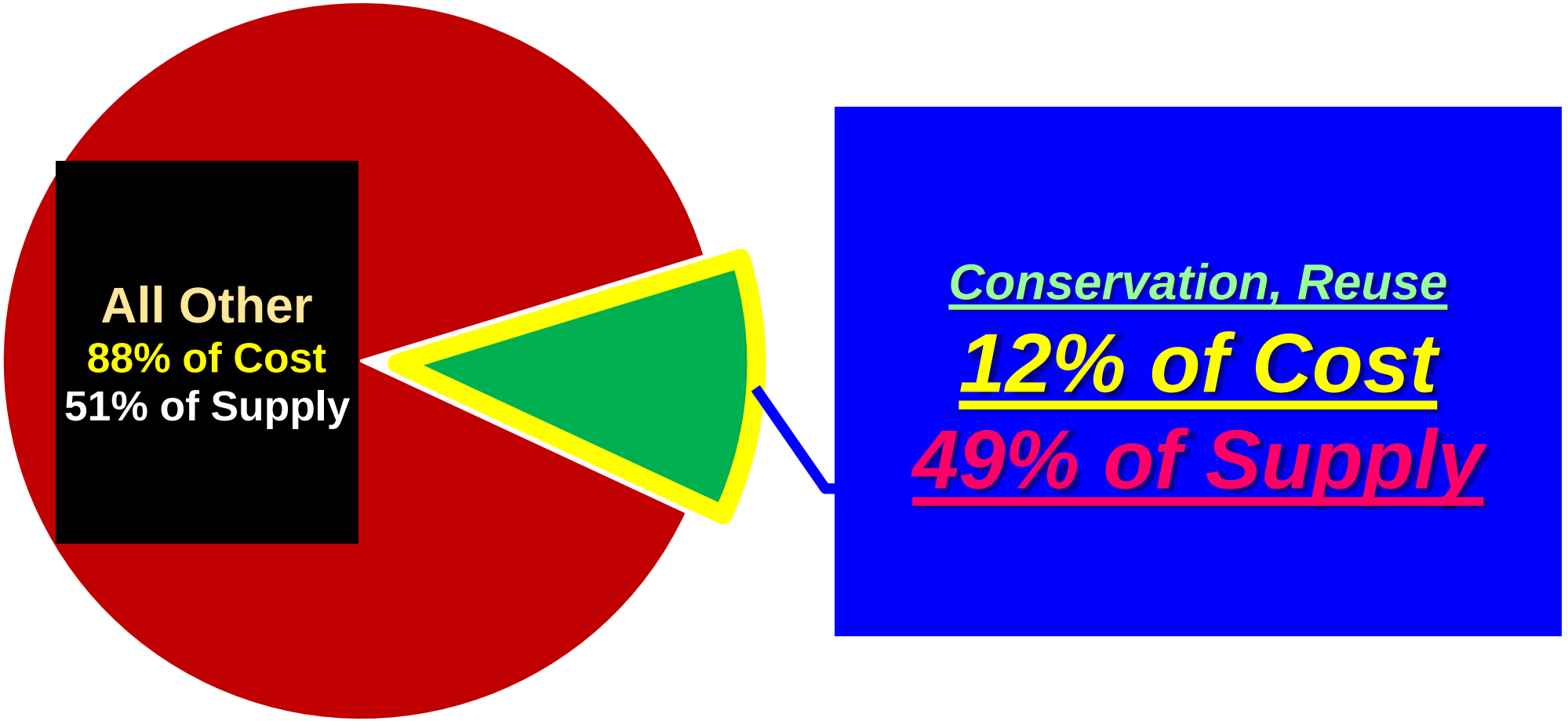


Texas 2017 Water Plan Cost in Dollars per Thousand Gallons



Capital Cost of Future Projects in 2017 Texas Water Plan - $62.6 Billion

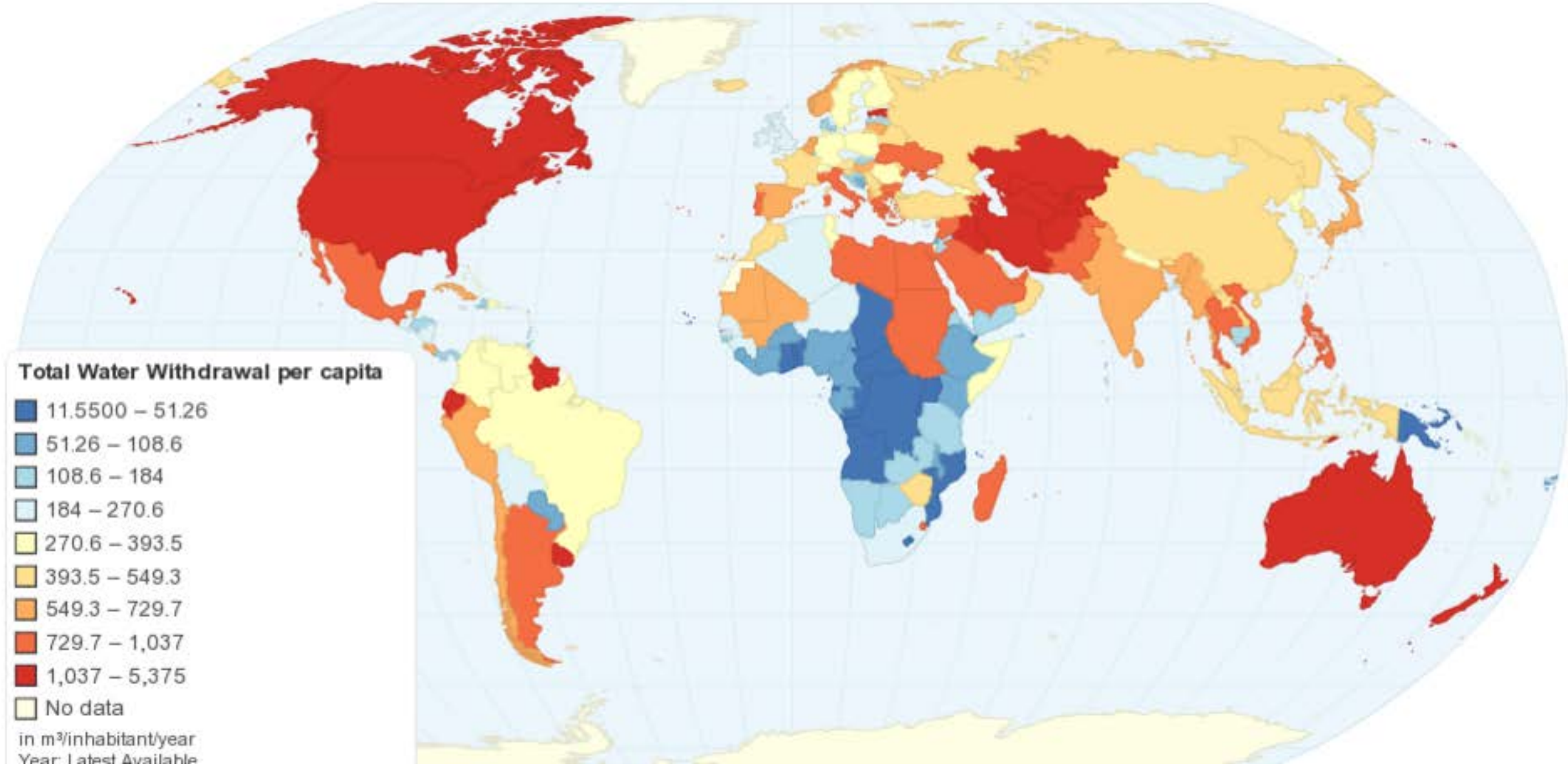
http://www.twdb.texas.gov/waterplanning/swp/2017/index.asp



The Cheapest Water You Will Ever Have Is The Water You Already Have!

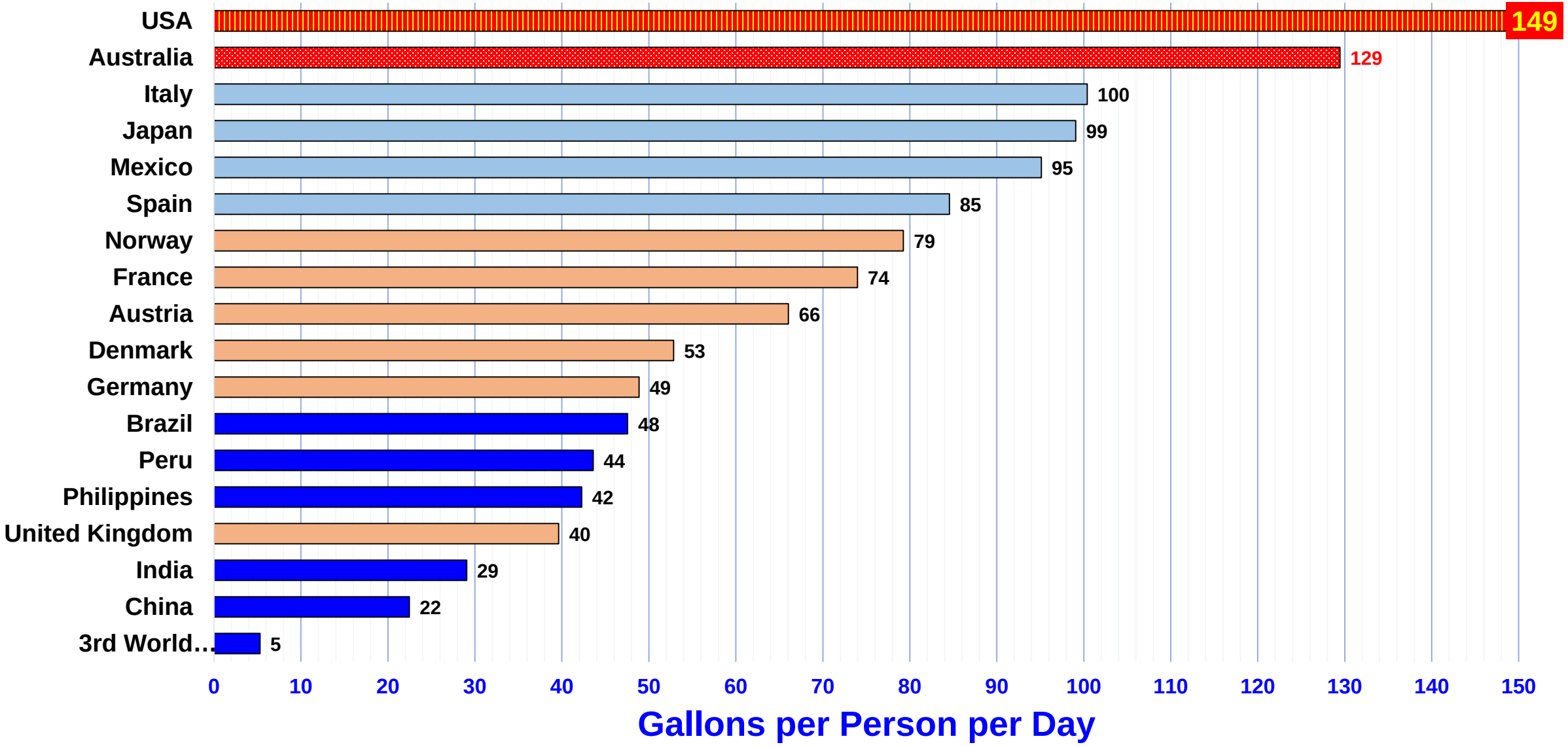
So How Do We Get To Where We Want To Be?

Total Water Use per capita by Country



Worldwide Municipal Per Capita Water Use

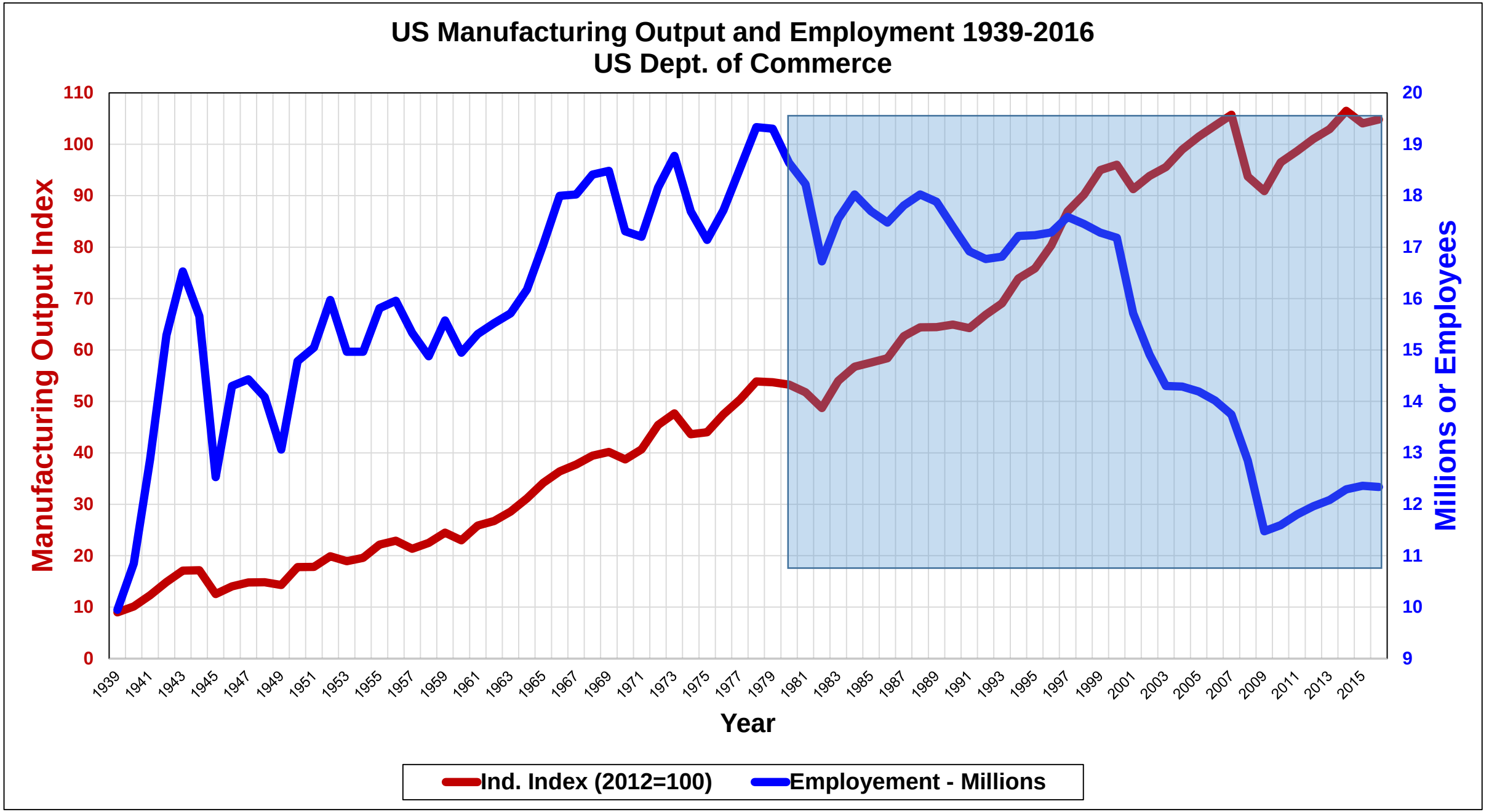
Source: Data 360
http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757



Big Data

is just now coming of age for water utilities.

- **AMI**
- **End Use Analysis**
- **Computerized Leak Detection**
- **Benchmarking to Determine Opportunities**
- **????????**


US Manufacturing Output and Employment 1939-2016
US Dept. of Commerce
Manufacturing Output Index
Millions or Employees
Year
Ind. Index (2012=100)
Employement - Millions

What We Need To Do

Technology & Codes

MEASURE, METER, MONITER, MANAGE

- Get water loss under control
- Reuse
- Keep pushing codes to higher levels
- Shoot for maximum WaterSense and EnergyStar adoption and beyond
- Look for unintended consequences
- Reduce both use and consumption

What We Need To Do, Cont.

Academic Side

- ***Beyond landscape water conservation*, incorporate urban and industrial water efficiency courses into university curriculum.**

- **Promote research in many forms that study and help develop water efficiency and reuse activities including, but not limited to:**
  - **Economics**
  - **Engineering**
  - **Horticulture**
  - **Statistics**
  - **Sociology**
  - **Business Studies**
  - **Architecture**

I.E. train the next generation!

What We Need To Do, Cont.

- Networking
- Certification or us (ICI, Program Coordinators, etc.)
- Establish permanent positons in utilities
- Better involve stakeholders and customers
- Properly project the impact on future water use (Porcupine effect)

The Porcupine Effect

After Maddaus Water Management

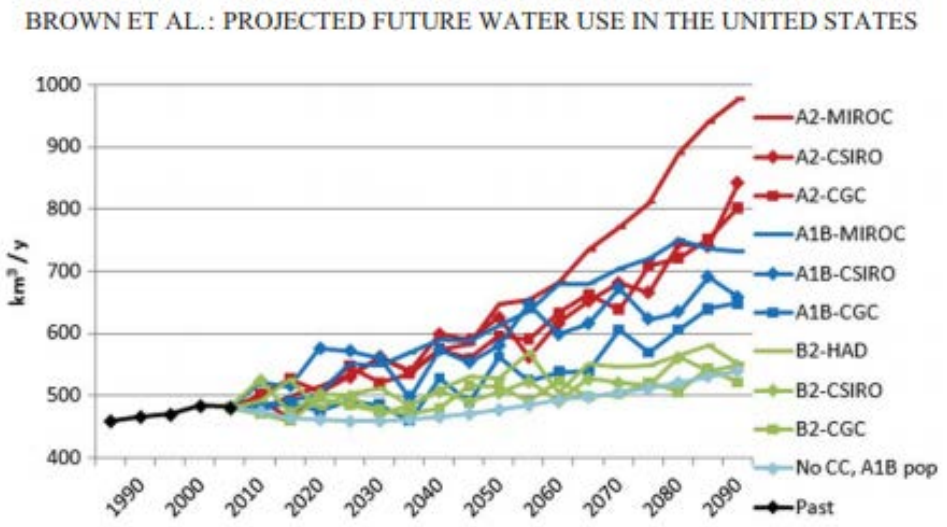
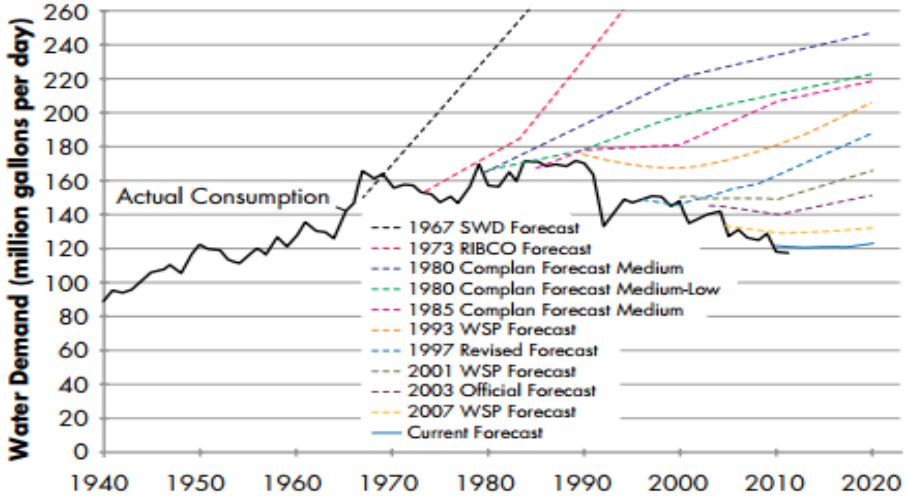


Figure 9. Past and projected withdrawal for the U.S. for alternative scenario-model combinations.



Failure to Conserve & Reuse will leave us hanging out there!

With Higher Level of Conservation and Reuse, We Can Actually

Use less Water

in the Urban and Industrial Sectors in 2067 than we did in 2017!

And **YOU** are on the front line!

Questions?

Past and Future 100 Years

1967 to 2067

Presented by

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