

Water & Energy Conservation

Relationships & Opportunities

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Topics Covered

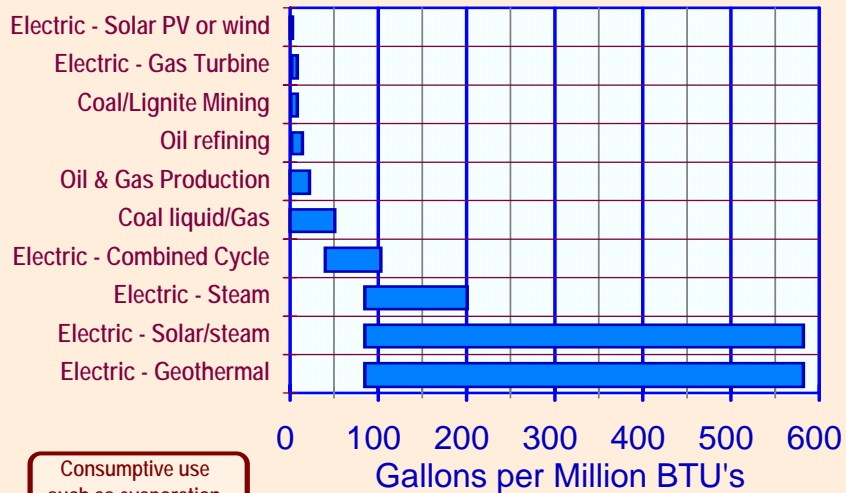
1. **Basic Relationships – Water/Energy**
2. **Austin's Water Conservation Programs** *(their impact on energy)*
3. **Four Examples** *(residential, commercial, institutional, industrial)*
4. **Air Quality Ramifications**

A Note on Rates

- **Electric rate of 7 cents per kWh**
- **For Commercial accounts, the combined water and wastewater rate is \$8.94 per 1,000 gallons.**
- **Comparable residential rates are used where applicable.**

Water for Energy Production

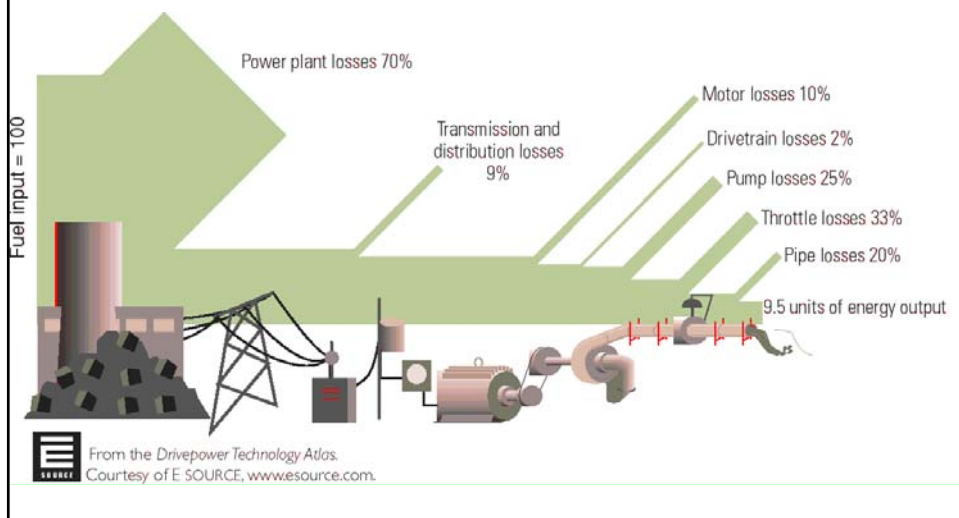
Gallons per Million BTU's



Where does the energy go?

- Texas currently uses about 11 Quad of input energy from oil, gas, coal, and nuclear inputs
- Uses include transportation, power generation, heating and all other uses.
- Of this 11 Quad, approximately 25% ends up in a cooling water system such as a tower or cooling pond.

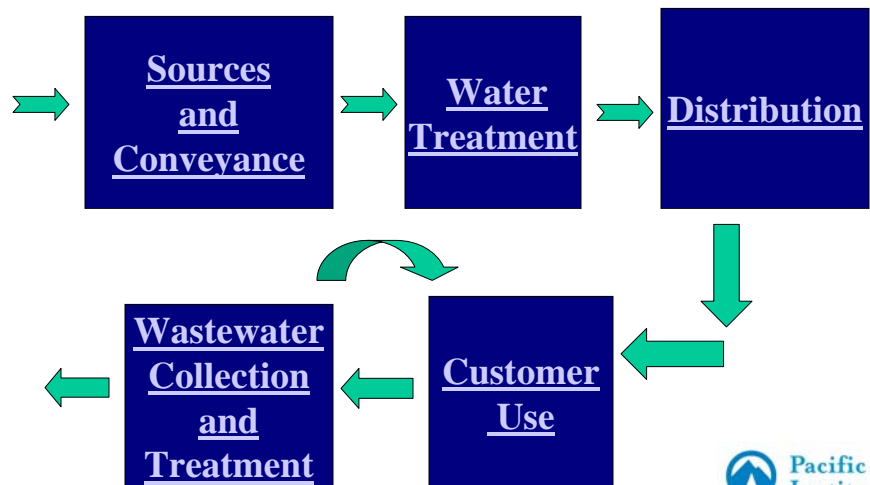
Compounding losses... or savings



Imbedded Energy

Imbedded energy is the energy consumed in all phases of providing water & wastewater services as well as the energy input by the user of the water.

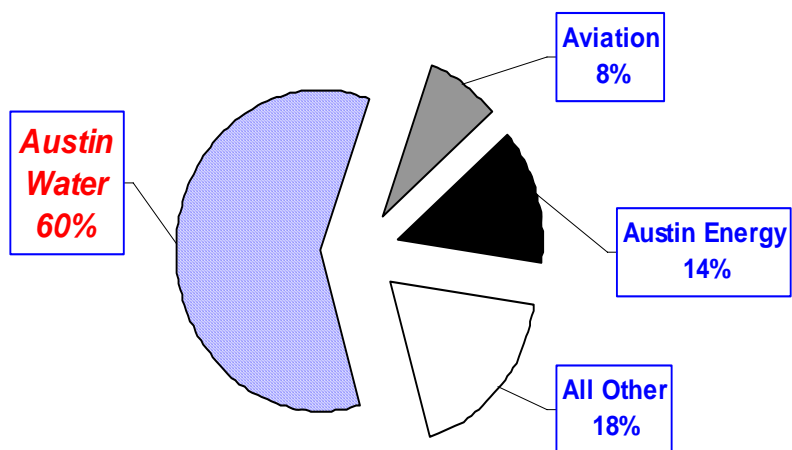
Categories for “Imbedded Energy in Water”

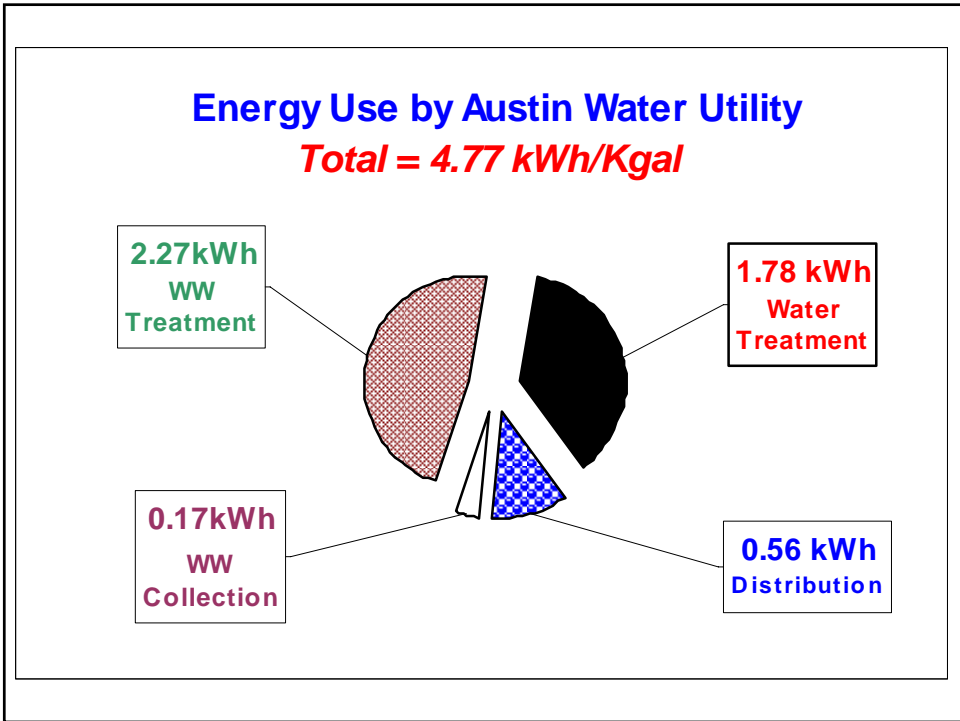
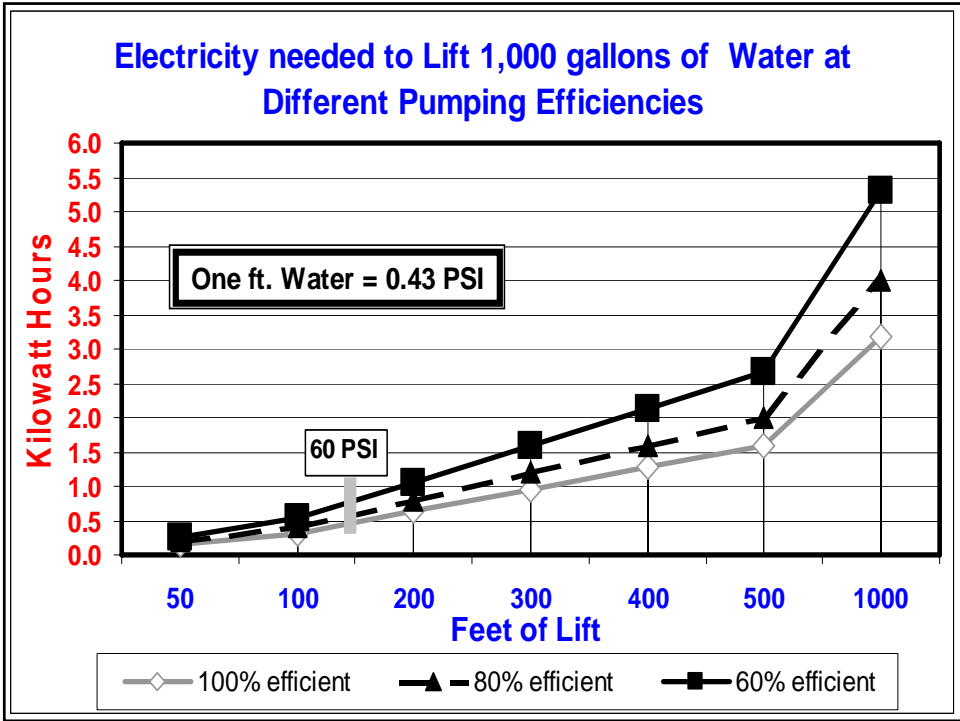


Water and Wastewater Utilities are Significant Energy Users

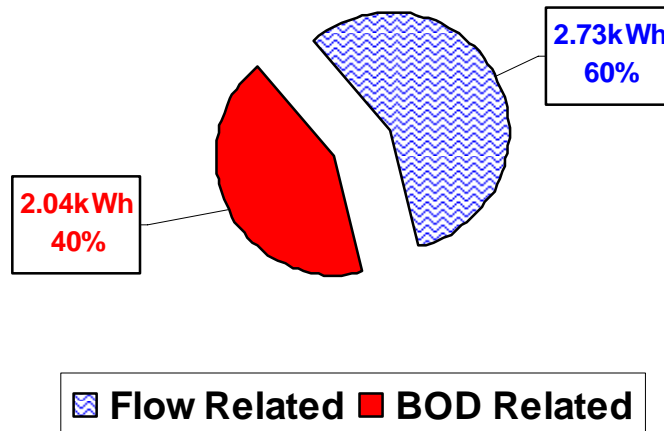
- In a typical city, water and wastewater electric bills are the largest single recurring bill the city pays and account for over half the electricity used by a city's governmental use for all purposes.
- Nationwide, some 3% to 4% of all electricity generated is used for pumping, treating or conveying water and wastewater including irrigation water.

Electric Energy Use by COA for all Departments





Energy Use that Water Conservation Can Impact Out of Total of 4.77 kWh/Kgal

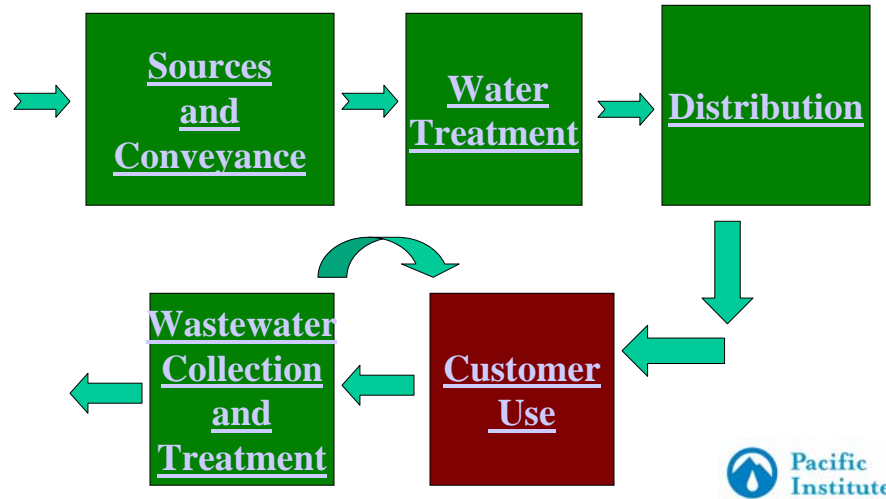


Imbedded Energy

Please note that if you reduce both water and wastewater use through conservation, the imbedded energy from the utility standpoint is 2.73 kWh/kgal, but for water only it is 2.34 kWh/kgal. *(1.78+0.56 kWh)*

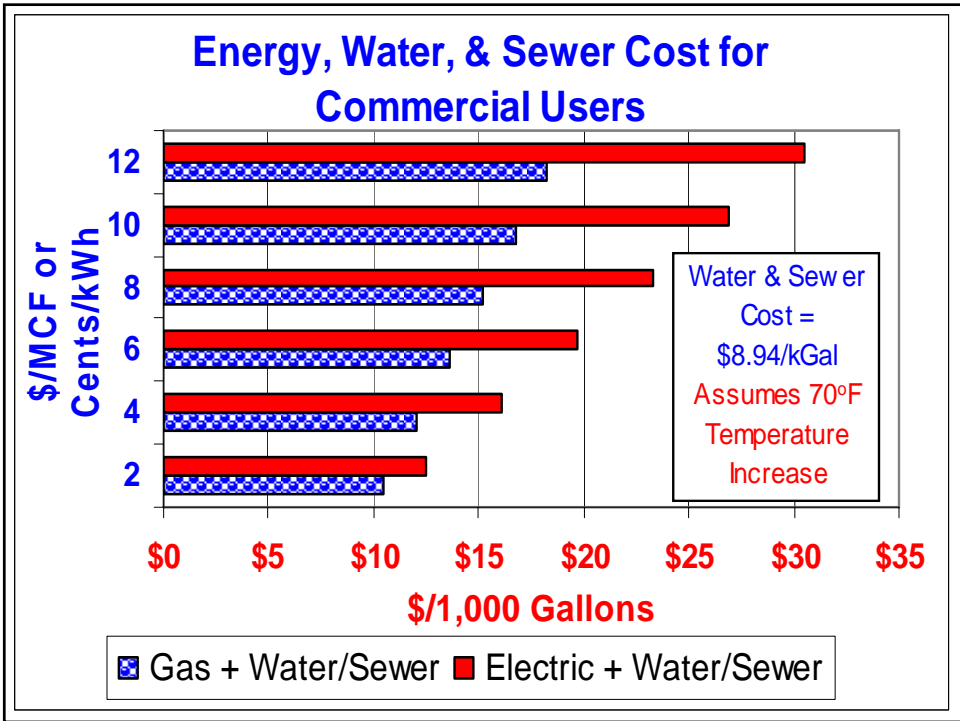
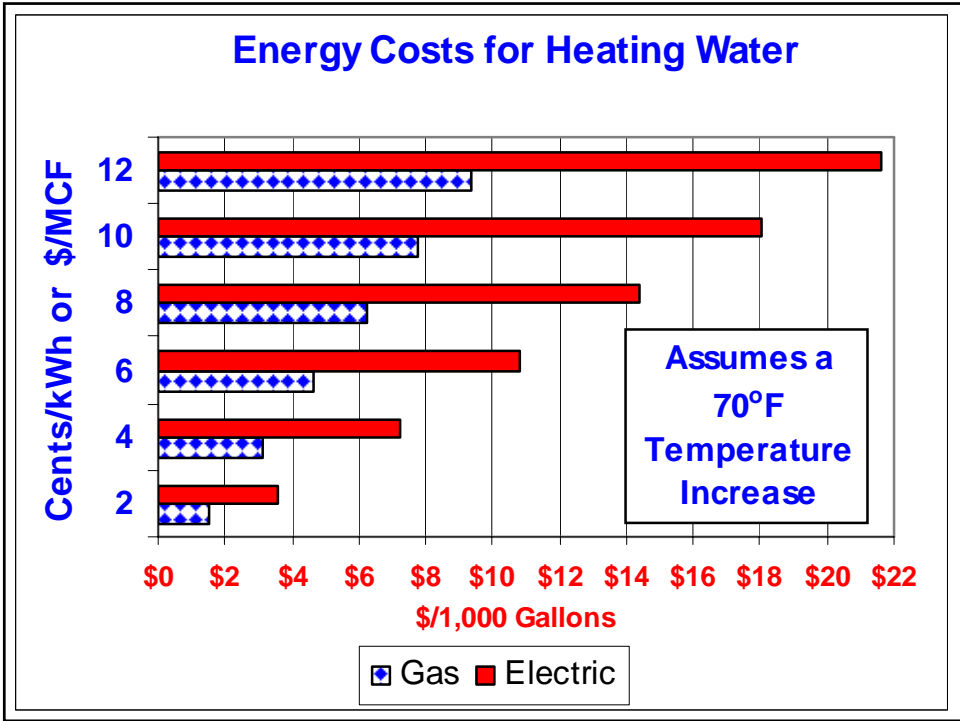
Examples would be a toilet retrofit vs. irrigation savings.

Focus on Customer Use



Customer Energy Input

- **Water Heating**
- **Additional Treatment**
(primarily industrial & commercial)
- **Additional Pumping**
(wastewater grinder pumps, etc.)



Residential Activities that Uses Both Water & Energy

- **Bathing** (*Showerhead retrofits save 5 to 20 gallons per shower*)
- **Clothes Washers** (*New clothes washers reduce water use by an average of 15 gallons per load*)
- **Dish Washing** (*Using modern water saving dishwashers can reduce water use by 20 gallons per load over hand washing*)

New CEE-Energy Starr Ratings for Clothes Washers

**Modified Energy Factor (MEF) of 1.80
or greater**

**Water Factor (WF) of 7.5 gallons per
cubic foot or less**

New Efficient Dishwashers

Using new dishwashers that do not require pre-washing in the sink can save over 20 gallons per load over hand washing.

Recommended Standards:

- **Energy factor 0.61 or greater**
- **Water Factor 6.5 gallons or less per load**

Commercial Examples Using Both Water & Energy

- **Pre-rinse Spray Valves**
- **Garbage Disposals**
- **Boilerless Steamers**
- **X-Ray Film Development**
- **Vacuum Pumps**

But Don't Forget the Imbedded Energy

<i>MEASURE</i>			Water	Customer *	Total
	Savings per	Water	Energy	Energy	Energy
	Measure	Savings	Savings	Savings	Savings
	Gal./Day	Gal./Year	kWh/Yr.	kWh/Yr.	kWh/Yr.
Residential Examples					
Toilet Rebates	25	9125	25		25
Clothes washer Rebates	15	5475	15	600	615
Commercial Examples					
Dental Vacuum Pumps	720	262800	717	1750	2467
Pre-rinse spray valve (restaurant)	200	73000	199	4370	4570
Remove Garbage Grinder	400	146000	399	8741	9139

* Energy used to operate the equipment

Pre-Rinse Spray Valves

Old Spray Valve

- 4-6 GPM
- 8-12 Cents/Min.

New Spray Valve

- 1.6 GPM
- 3.2 Cents/Min.

Replacing Garbage Disposals with Strainer Systems

- Water Use – Grinders from 2 to 12 gpm
Scrap baskets 0.0 gpm
- Horse Power – Grinders from 1 to 10 hp
Scrap baskets 0.0 hp

Boilerless Steamers

- 90% less water
- 75% less energy
- No water hookup
- No sewer hookup
- No vent

X-Ray Film Developers

- Old machines dump 0.5 to 1.0 gpm for cooling
- Recirculating systems reduce use by up to 80%, but
- The new wave is to digital technology that eliminates all water use and are more energy efficient.

Vacuum Pumps

Old Liquid Ring pumps can use as much as one thousand gallons of water a day

Dry systems eliminate water use and are more energy efficient

2005 EPAC Code Requirements

- ***Clothes Washers***

- ✓ *Requires MEF of 1.26 or greater .*

- ✓ *Requires a water factor of 9.5 gallons per cubic foot or less.*

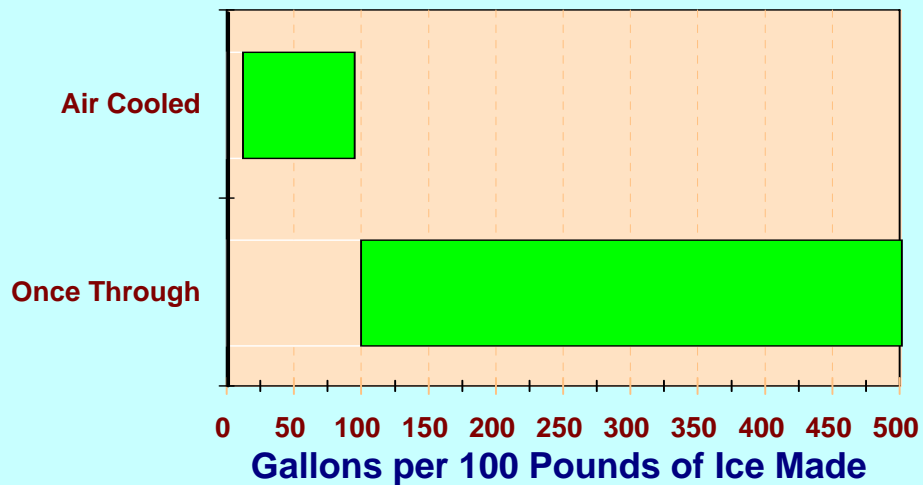
- ***Pre-Rinse Spray Valves***

- ✓ *Limits water use to no more that 1.6 gal./min. at 60 psi.*

Ice Machines:

***Why one should look at
all utility inputs.***

Comparison of Water Use for Ice Making *Commercial Units*



Daily Electric and Water/Wastewater Costs

<i>Summary of Total Cost per Day (Elec. plus Water)</i>	
AIR COOLED IN AIR CONDITIONED SPACE	\$5.39
AIR COOLED IN UN AIR-CONDITIONED SPACE	\$4.33
AIR COOLED REMOTE HEAD	\$4.24
AIR COOLED IN A/C SPACE WITH COOLING TOWER	\$5.84
WATER COOLED	\$14.95

Life Cycle Costs

LIFETIME OPERATING COST OF ICE MACHINES (water and energy)	
<u>Equals days of operation a year X cost per day X</u> <u>life of machine</u>	
Lifetime of ice machine in years	7
AIR COOLED IN UN AIR-CONDITIONED SPACE	\$11,055.65
AIR COOLED REMOTE HEAD	\$10,826.72
AIR COOLED IN AIR CONDITIONED SPACE	\$13,770.57
AIR COOLED IN A/C SPACE WITH COOLING TOWER	\$14,926.36
WATER COOLED	\$38,188.53

Rebates in Austin

- **Unique joint energy and water rebates for:**
 - ✓ **Commercial and residential clothes washers**
 - ✓ **Dry Vacuum Pumps**
 - ✓ **Scrap Baskets to replace garbage dispose-alls**

Cooling Towers

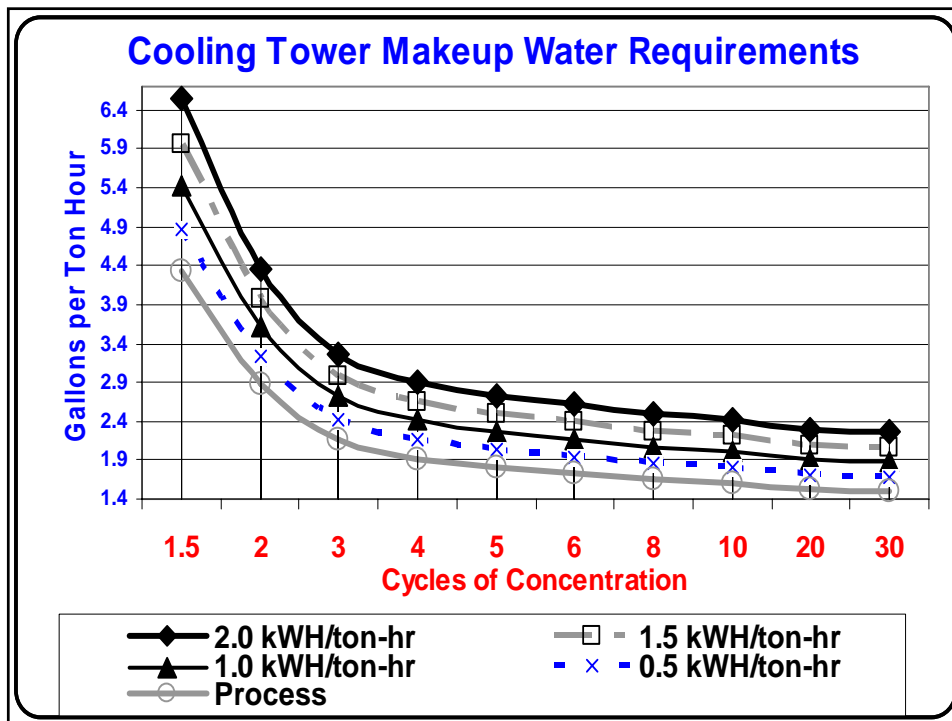
- Purpose – to remove unwanted energy from process fluids
- Major Use – HVAC systems
- Process Fluid in HVAC Systems - *water*

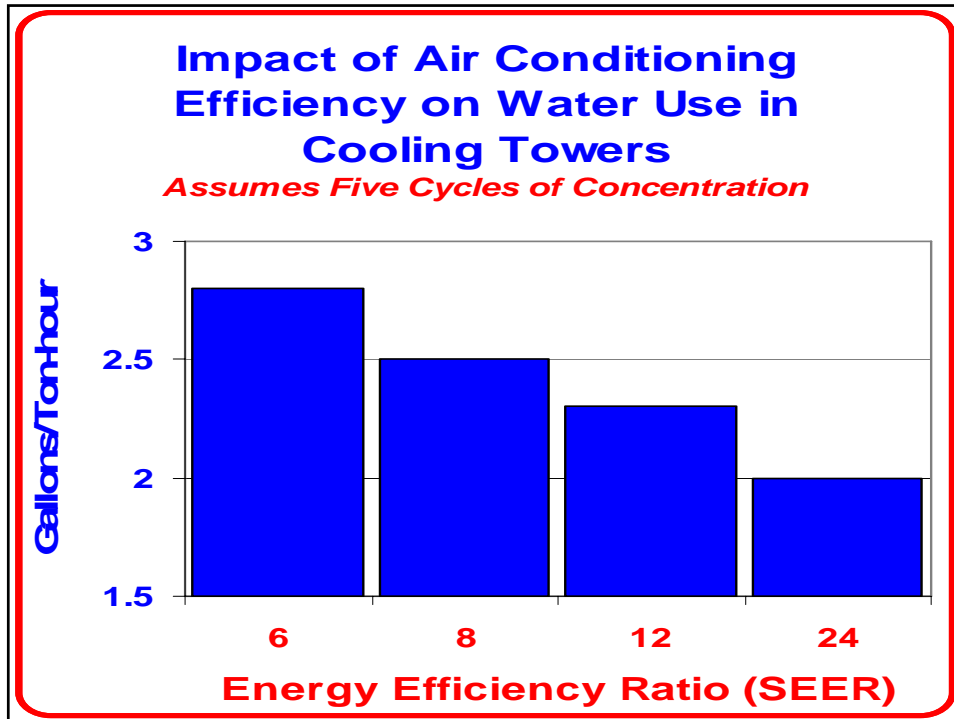
Ways to Reduce Water Use for Towers

1. Energy conservation to reduce heat load
2. More efficient HVAC equipment
3. Better cooling tower operations
(Cycles of Concentration)

Cooling Towers vs. Air Cooling

- Water is a better heat transfer media so with towers, the overall energy efficiency increases and cools to wet bulb Temp.
- With towers, the cost of water and water treatment is in the range of \$0.02 to \$0.03 per ton-hour
- For cooling towers to be cost effective over air, energy efficiency must increase by at least 40%. That is equal to an increase from an EER of 12 to 18.





Four Austin Examples

1. **Freescale Semiconductor**
(industrial)
2. **New Children's Hospital**
(institutional)
3. **Waller Creek Center** (commercial)
4. **Austin Housing Authority**
(residential)

Freescale Reduces Water & Energy Use

Freescale must heat water in cooler months to achieve maximum efficiency of operation in their ultra-pure water system's RO process.

They were using gas, but with rebate from City, they installed heat exchangers to use waste process heat.

Result of Freescale Efforts

- By using waste heat, they reduced load on their cooling towers saving an average of 14,500 gallons of feed water to the cooling tower daily.**
- They reduced natural gas demand by over 90 MCF daily.**

Old Airport Redevelopment

- **Major mixed use facility including new children's hospital**
- **City to build on-site energy facility**

Impact of On-Site Project

- ✓ **Gas turbine 4.5 – 5.0 MW**
- ✓ **Exhaust heat used for hot water, steam, and absorption A/C system**
- ✓ **Phase I includes 1,000 tons of absorption A/C & 1,500 tons of conventional A/C.**
- ✓ **Use reclaimed water in cooling tower.**

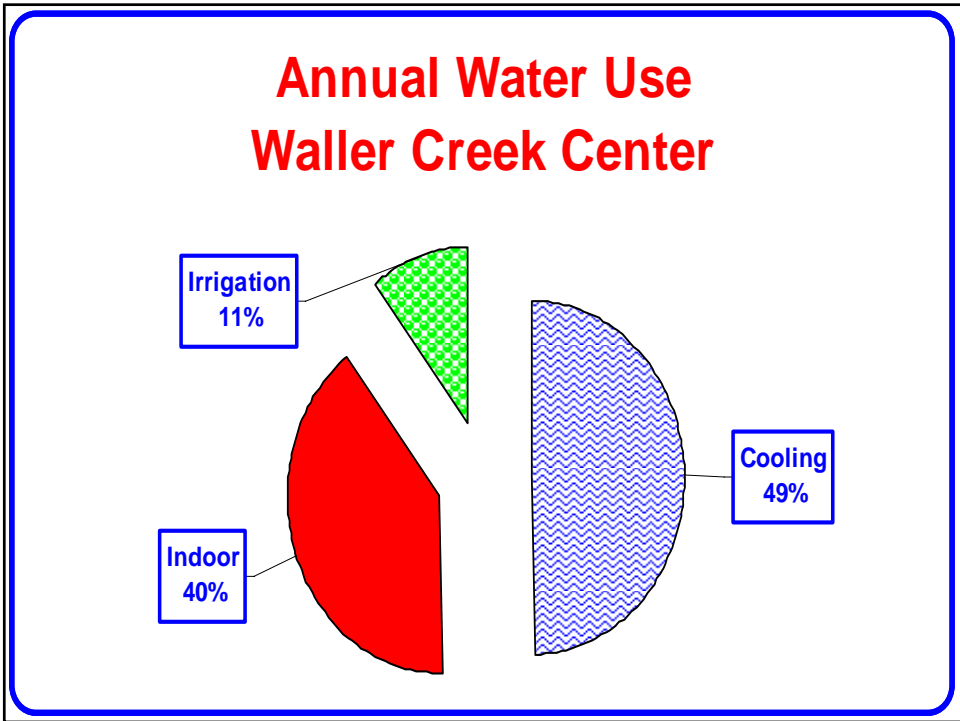
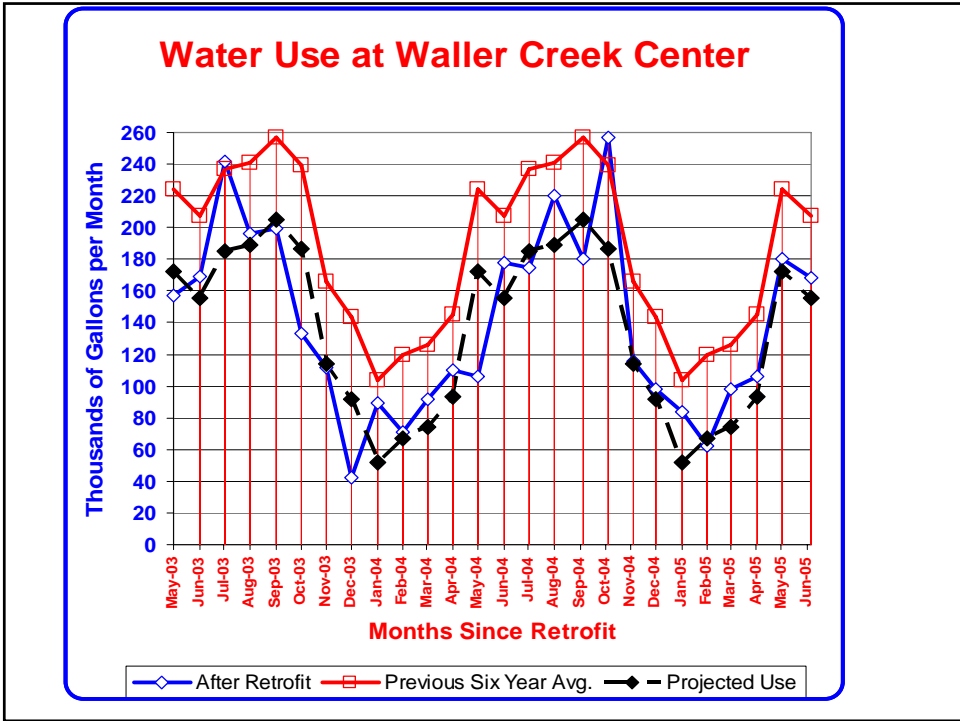
The Results

- The gas turbine – NO water used for cooling
- 90% of waste heat will be recovered
- Reclaimed water offsets potable use.
- Imbedded energy in reclaimed water only equal to pumping needs

Waller Creek Center

*10 story office building: headquarters
for Austin Water Utility*

- Retrofitted lighting
- Upgraded A/C compressor
- New cooling tower –cycles of concentration to over 8
- Retrofitted plumbing.

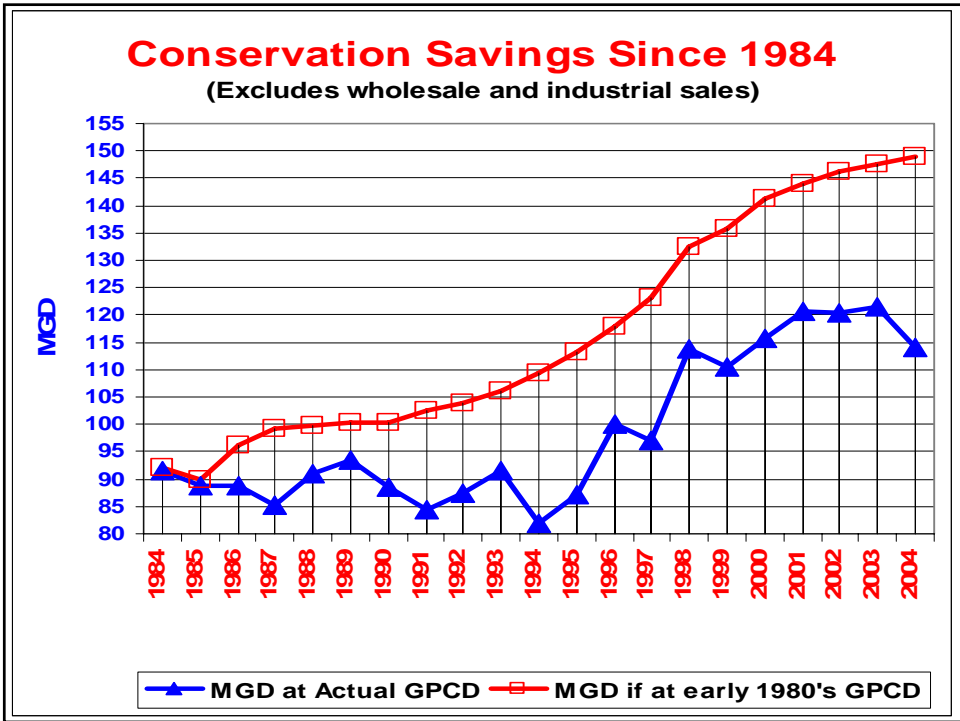
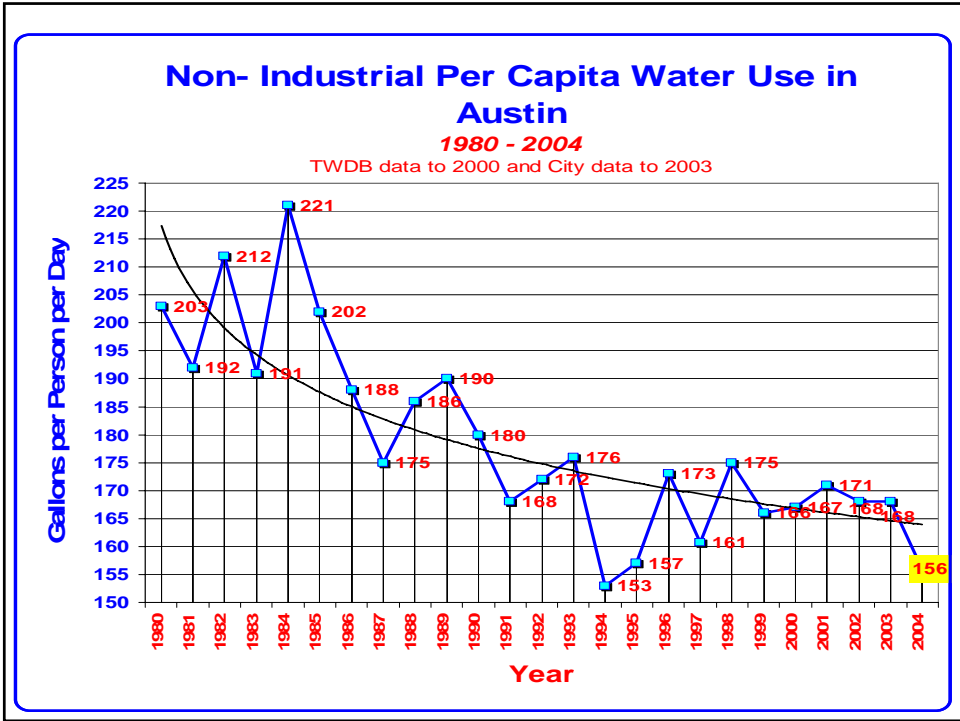


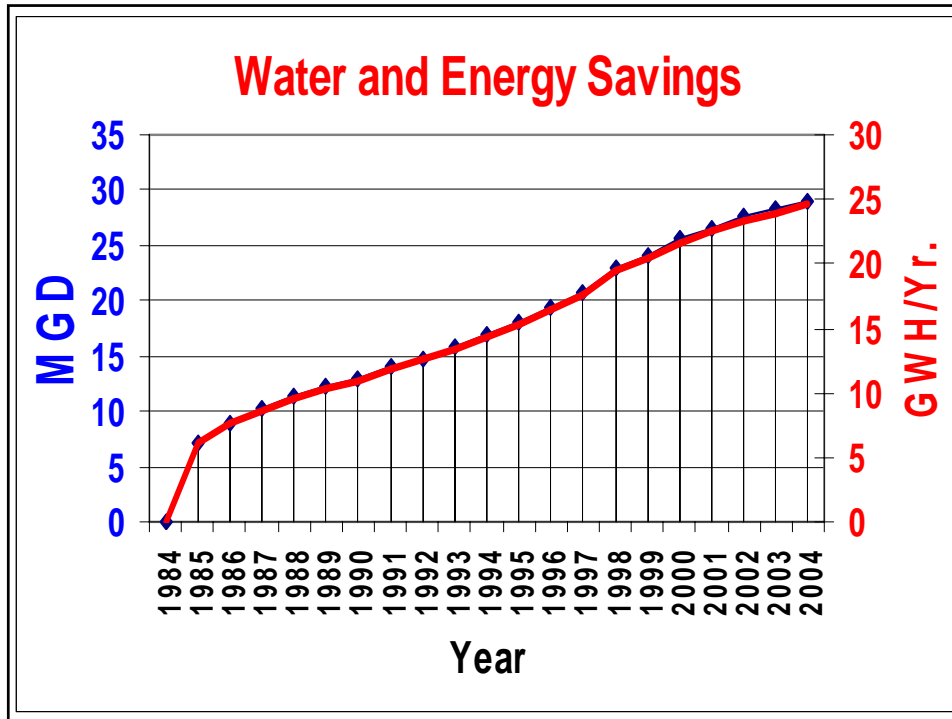
Austin Housing Authority

- ✓ **Retrofitted 1,400 toilets + showerheads and aerators**
- ✓ **Made improvements to cooling towers**
- ✓ **Fixed many leaks**
- ✓ **Removed outdoor faucets**
- ✓ **Educated residents**

Retrofit Results

- **Reduced water use by 55,000 gallons a day**
- **Reduced energy use for hot water by 30%**
- **Saving \$ 250,000 per year**





And then the Air

- **Water conservation reduces energy use**

- **Reduced energy production means reduced air pollution**

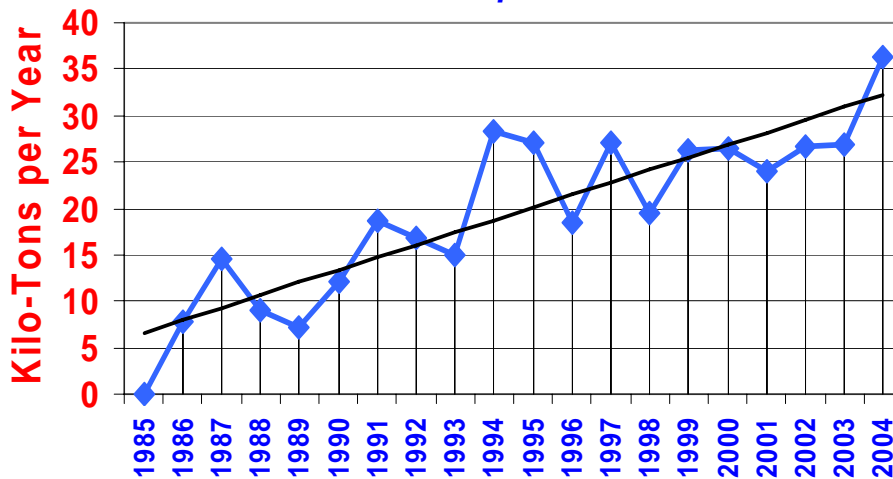
Air Pollution

Based on Austin Mix of Generation

Pollutants	SO _x	NO _x	Particu- lates	CO	CO ₂
Grams/ Kilowatt - Hour	1.58	1.22	0.13	0.16	540
Grams / thousand gallons	7.54	5.82	0.62	0.76	2567

Annual CO₂ Reduction By Water Conservation

Kilo-Tons per Year



The End