



### LESSON 3:

# *Energy and Water Efficiency*

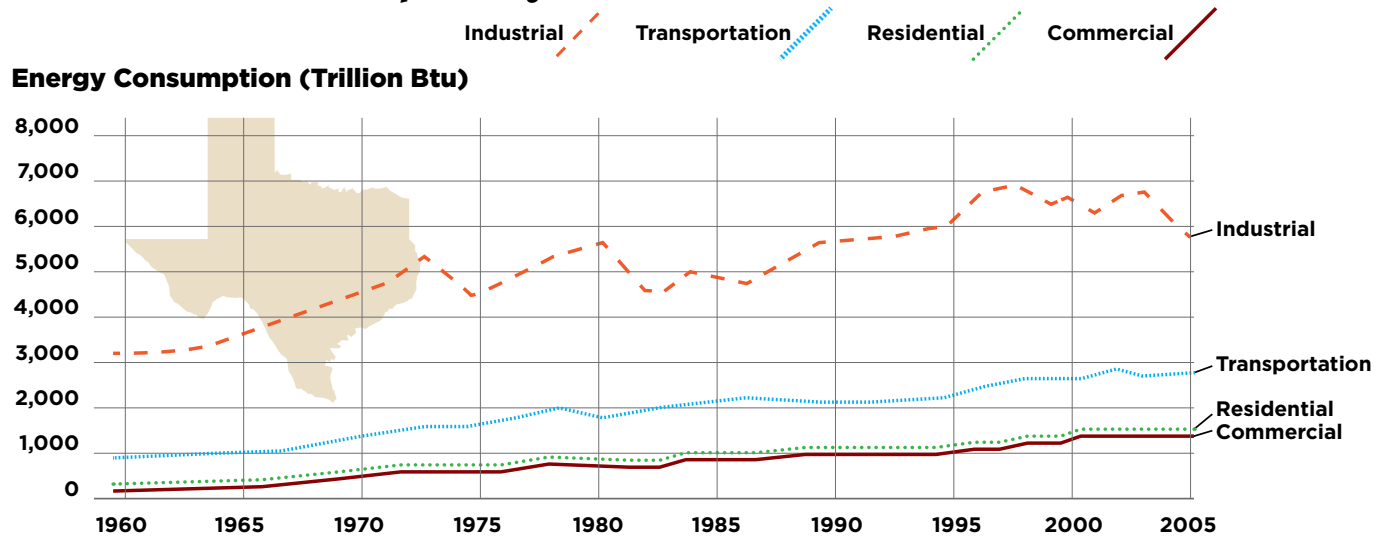
As the population in the state of Texas continues to grow, many are taking a good look at ways to increase energy and water efficiency. Could the state known as the biggest user of energy also become known as the most efficient user of energy? Many in the state of Texas think so and also hope Texas will become a leader in the field of energy efficiency.

In order to make changes in energy usage, it is a good idea to understand how Texans use energy. The graph on page 2 shows where energy is consumed.<sup>13</sup> The category for industrial use includes the manufacturing of petroleum and coal products, as well as computers. The transportation category includes fueling vehicles, trucks, and buses. Residential and commercial use includes keeping the lights on inside buildings and homes as well as heating and cooling them.

**POWER**  
**TO SAVE**  
**TEXAS**



## Texas Annual Consumption by Sector

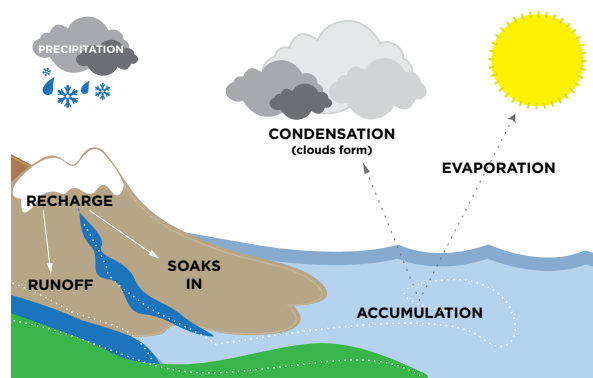


When talking about becoming more energy efficient with the resources in Texas, one resource that probably comes to mind is water. Water is the most important resource on the planet. Without it, there would be no plants, animals, or people. A person can survive for a month or more without eating food, but only for about a week without drinking water. Water must be managed carefully.

It may sound funny, but our water is old! All the water on Earth, the water in your glass, the water with which you brush your teeth, all that water is about 4.4 billion years old. No water is being made or destroyed on the globe. Earth has always held the same amount of water. The water we have today has been used over and over again. Dinosaurs drank the water, and so did George Washington, long before we ever did.

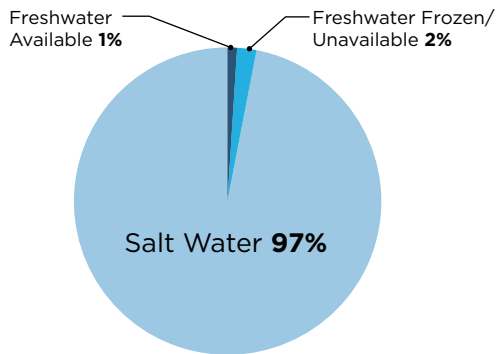
Water is considered a **renewable resource** because it does not disappear, it simply gets moved around in Earth's natural

recycling system. This system is called the water cycle, or **hydrologic cycle**. Water is constantly changing through this never-ending process as it moves from the land and ocean to the atmosphere and back. The atmosphere is the entire mass of air surrounding the earth. Water evaporates, condenses (forms clouds), falls back to Earth as precipitation, collects in bodies of water (lakes, rivers, and oceans), and then the cycle begins again. See the picture below.<sup>14</sup>



**Water** covers about 70% of the earth, yet less than one percent (<1%) of the world's fresh water (~0.007% of all water on

Earth) is available to use. This includes all the water found in lakes, rivers, reservoirs, and even underground water that is shallow enough to be reached. This very small amount of freshwater, replenished by rain and snowfall through the hydrologic cycle, is all there is for us to use.<sup>15</sup>



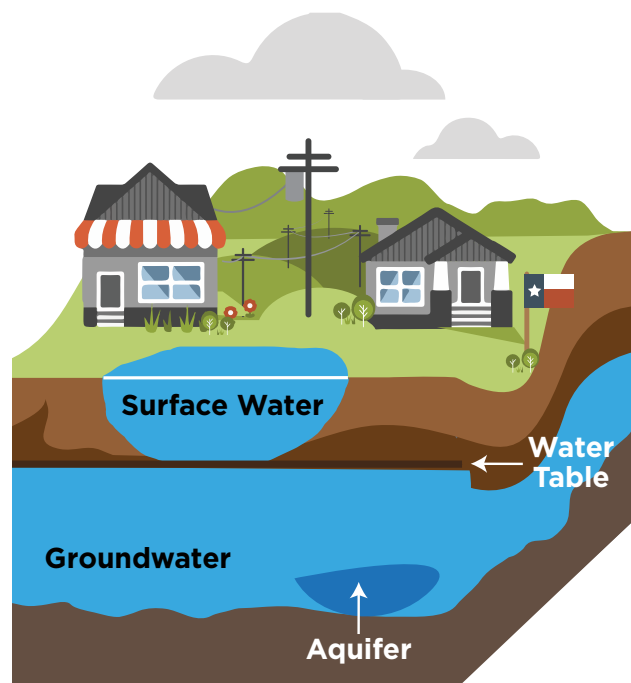
It may be hard to believe there is so much water on our planet, yet so little available to us. Most freshwater returns to the atmosphere by **evapotranspiration**. This simply means that water moves to the air from the earth's surface (**evaporation**), and the water moves as vapor (**transpiration**) from plants, grasses, and trees. The sum of evaporation plus transpiration equals evapotranspiration. In this part of the water cycle, fresh water we could have used simply returns to the atmosphere.<sup>16</sup>

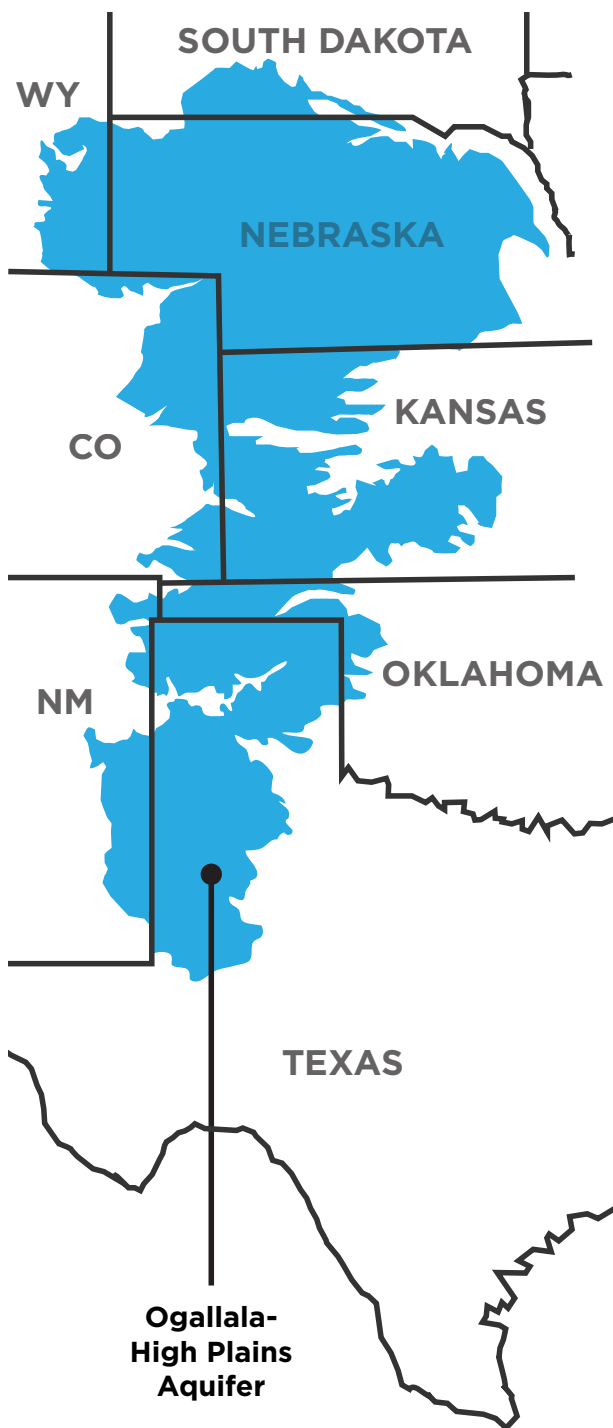
As the picture to the right shows, water on top of the earth's surface is called **surface water**.<sup>17</sup> Examples of surface water include creeks, lakes, streams, rivers, wetlands, and oceans. When you pass a natural spring and water appears to be flowing as if from nowhere, the source is often groundwater. **Groundwater** is the water that seeps into the earth and is stored in aquifers.

This underground water makes its way into lakes and rivers. Sometimes this water is tapped by wells for drinking or irrigation.

Aquifers are areas of soil, sand, and rock that are able to hold liquid. Groundwater sits in the aquifer and is usually replenished by rain and snow. Groundwater stored in aquifers can be found either close to the earth's surface or hundreds of feet below. As groundwater moves through aquifers, sediment and other particles are trapped within the spaces of aquifer rock. In this way, aquifers act like natural filters to help purify groundwater.

The word aquifer means water-bearing, formed from the Latin "aqua" (water) and "ferre" (to bear). This underground source is in more danger today due to population increases. Even though polluted water from agricultural and





urban runoff seeps into groundwater sources, the biggest threat of this limited resource is overuse.

The Ogallala Aquifer is one of the largest aquifers in the world and is located across eight states in the United States: South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas. Like many aquifer systems throughout the world, the Ogallala Aquifer is shrinking.<sup>18</sup>

In 2005, the groundwater in the Ogallala Aquifer was recorded at 3,600 cubic kilometers. Between 2005 and 2010, the amount of water in the aquifer reduced by 300 cubic kilometers. One cubic kilometer equals 264 billion gallons!

As the graph on page 5 displays, the biggest use for groundwater in Texas is **irrigation**.<sup>19</sup> Although other sources of groundwater usage exist, the irrigation of crops like corn and cotton is especially heavy in West Texas and South Texas. Farming and ranching make up about 10 percent of the state's economy, and this translates into jobs for many Texans.

When considering the 300 cubic kilometers of groundwater lost by the Ogallala Aquifer, you might wonder how the land above the aquifer changed. One result is a lowering of the ground's surface, or **subsidence**. The basic cause of land subsidence is a loss of support below ground. When too much water is taken out of the soil, the soil collapses, compacts, and drops. Land subsidence leads to many problems including changes in elevation, flooding, and sinkholes.

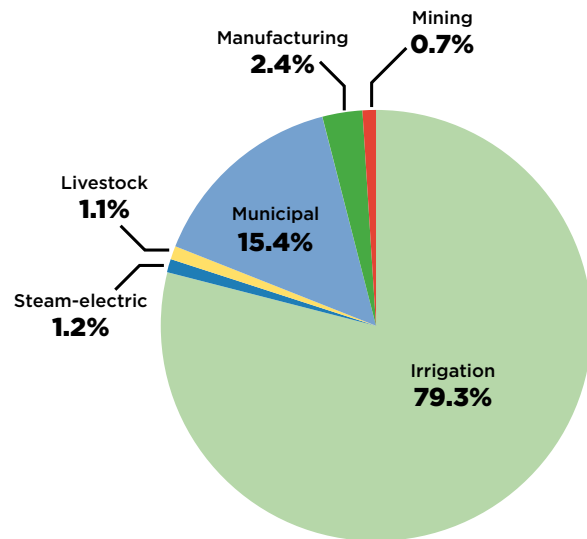
In some of the land areas along Galveston Bay, the land surface has sunk as much as 10 feet since 1906. Flooding becomes a concern because the land is lower, drier, and usually compacted from shrinking. One hundred years of intense groundwater pumping in the Houston area has collapsed the layers of the Gulf Coast Aquifer, causing the land above it to sink. These changes in elevation can cause major damage to buildings, roads, and bridges.<sup>20</sup>



As we study using and valuing water, it is good to know that water use is described in two ways: water withdrawal and water consumption. There is a big difference between the two terms.

**Water withdrawal** refers to water that is redirected or withdrawn from its source – surface water or groundwater. **Water consumption** refers to water withdrawn from its source permanently; it is no longer available for other uses because it has evaporated, been used by plants, or consumed by people or livestock. Once consumed, the water needs to be treated before it can be used again.

People commonly think of water use and water consumption together. However, this is not accurate because water withdrawal refers to water that can be used over and over again, as in the case of a hydroelectric power plant. Water is used temporarily to cool the power plant, then is returned to its original location, perhaps a reservoir. The next lesson will discuss this concept



Sources: Texas Water Development Board and Texas Comptroller of Public Accounts

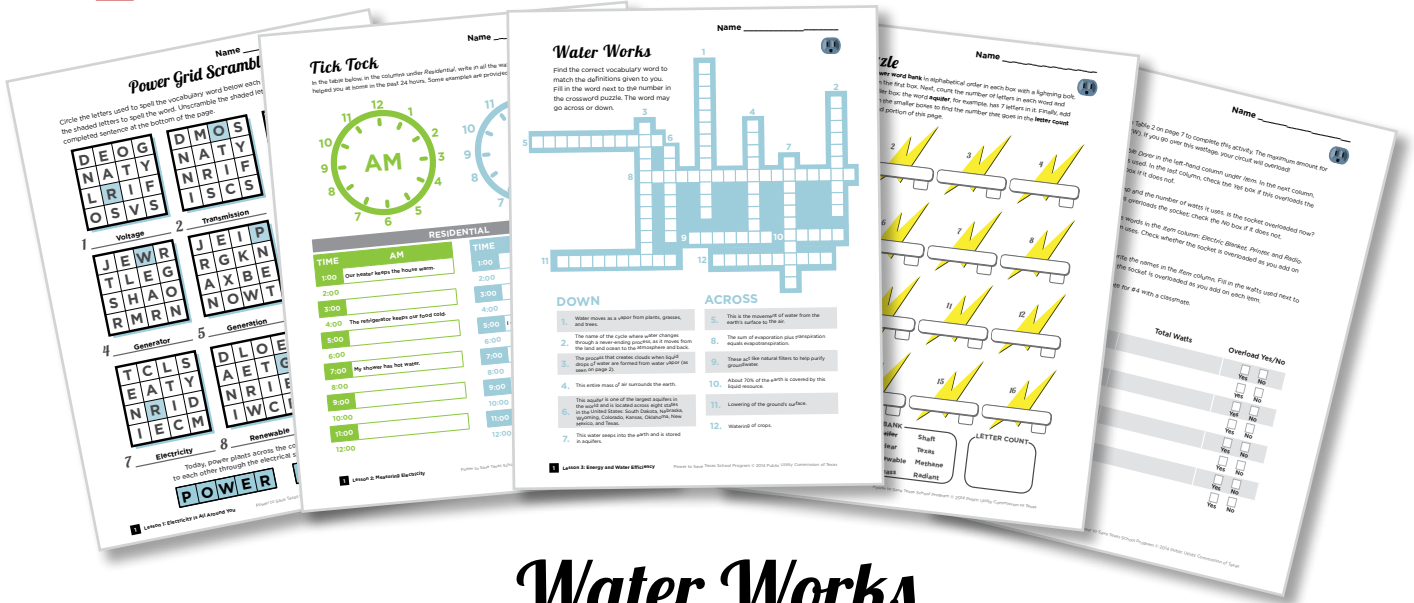
in more detail. Understanding how water is used, or more specifically, how water is withdrawn or consumed, is key to using it more wisely.<sup>21</sup>

The idea of land subsidence and depleting aquifers may start you thinking about becoming more efficient with your water use. Wasting water just doesn't make sense. Even so, the average American wastes thousands of gallons of water each year. Gallons of water are wasted during daily activities, such as taking long showers, running the hose while washing the car, or simply letting the water run straight down the drain.

In America, our water consumption has increased 127% from 1950, while much of the world lives off 3 gallons of water per day or less. To put that into perspective, we can waste 3 gallons of water with one flush of the toilet.<sup>22</sup> That's a lot!

## *Easy Changes to Start Making Today*

<b>1</b>	Throw used tissue into the wastepaper basket rather than the toilet.
<b>2</b>	Keep an eye out for leaky faucets.
<b>3</b>	When brushing your teeth, pour some water in a cup to use for rinsing instead of letting the water run.
<b>4</b>	When trying to get the faucet water warm or cold, catch the running water for plants or animals in or around the home.
<b>5</b>	Time yourself when taking a shower.
<b>6</b>	Run the dishwasher only when you have a full load. The same is true for washing clothes in the washing machine.
<b>7</b>	If you wash dishes by hand, don't leave the water running.
<b>8</b>	Use a broom for sweeping the driveway or sidewalk, not water from the hose.
<b>9</b>	Keep a bottle of drinking water in the fridge; it will always be cold.
<b>10</b>	Water lawns and shrubs early in the day when the air is still cool, and the wind is usually calm. <sup>23</sup>






# Water Works

Ask your teacher for the Water Works activity. You will receive one of three versions. Water Works uses vocabulary words to match definitions, complete a traditional crossword, or create definitions.

## Long-Term Savings for Homes Tips

### ELECTRIC WATER HEATER

-  Repair leaks on warm-water faucets. These leaks just drain your water heater, which means it has to heat more water. That process costs you more.
-  Drain your hot water tank regularly to remove sediment.
-  If buying a new water heater, consider a tankless unit. These systems are 35-45% more efficient. Plus, you'll never run out of hot water.

See more at [www.powertosavetexas.org](http://www.powertosavetexas.org).

Scan this QR Code with your smartphone to visit the program website.



## Career Connection / Job Profile:



*Are you interested in how machines work?*

*Do you like using math?*

*Are you good at following rules and laws?*

If you answered, “Yes,” to these questions, you might like to be a water treatment plant operator. These workers run plants that treat water so it is safe to drink. They also treat water after it is used so it is safe for it to go back into rivers, lakes, and the ocean.

### ***As a water treatment plant operator, you would:***

- Use machines to clean water, remove sewage, and make power.
- Check equipment to make sure it works correctly.
- Use tools to maintain and repair machines.
- Use chemicals to clean water.
- Test water samples to make sure it is clean.
- Use tools to clean and maintain water tanks and filters.
- Keep daily records of the work at the plant.
- Manage other plant workers.

### ***Will There Be Jobs in the Future?***

In Texas, this occupation has high growth potential. Nationally, this occupation is growing at an average rate.

### ***Education Required:***

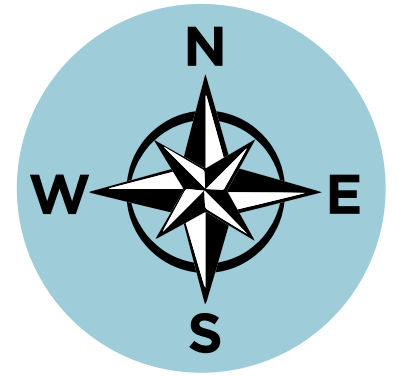
To work as a water treatment plant operator, you typically need to:

- Have a high school diploma or GED; and
- Complete long-term, on-the-job training; and
- Pass state or local licensing exams.

*Provided courtesy of: [www.onetonline.org](http://www.onetonline.org)*



## Career Connection / Job Profile:



*Are you good at reading maps?*

*Do you like using a computer?*

*Are you interested in where people live?*

If you answered, “Yes,” to these questions, you might like to be a geographer. Geographers study the features of the earth and how people use the land they live on. They often use special computer software called GIS (geographical information systems) to do tasks. Many geographers work for the federal government. Others work for private companies or colleges and universities.

### ***As a geographer, you would:***

- Study the earth and its people on a local or global scale.
- Collect data from maps, satellite photos, and from trips to sites.
- Study land features of an area, such as the plants, rocks, and climate.
- Study the culture of a group of people in a region.
- Use GIS to create maps, graphs, or diagrams.
- Give GIS data to companies that need it.
- Keep GIS software and devices in good working order.
- Give advice on issues such as where to put a new shopping center.
- Write reports and give talks about research findings.
- Teach courses to college students.

### ***Will There Be Jobs in the Future?***

In Texas and nationally, this occupation is growing at an average rate.

### ***Education Required:***

To work as a geographer, you typically need to:

- Have a high school diploma or GED; and
- Have at least a bachelor’s degree in geography.

*Provided courtesy of: [www.onetonline.org](http://www.onetonline.org)*