

Introduction

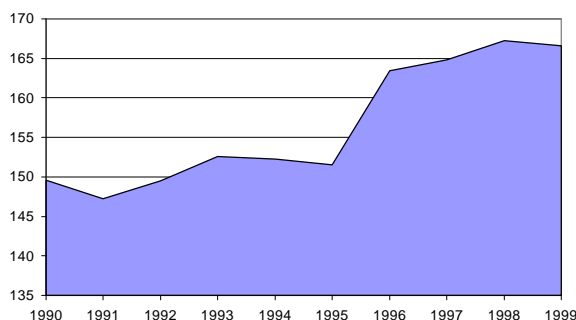
Global warming is one of Texas' foremost threats – economically, socially and environmentally – of the new century. **Increases in the concentration of greenhouse gases (GHGs) in the atmosphere are expected to result in higher regional temperatures, more frequent intense storms, rising sea levels, and changes in water flows and quality.** There is broad agreement in the scientific community that human activities are contributing to these changes. This is largely the result of releasing carbon dioxide and other GHGs into the atmosphere through burning fossil fuels.

The Union of Concerned Scientists (UCS) and the Ecological Society of America (ESA) conducted the most recent study on global warming and Texas. In *Confronting Climate Change in the Gulf Coast Region*, UCS/ESA find that in the next 100 years, summer temperatures in Texas could increase by 3-7°F and minimum winter temperatures could increase from 3°F to about 10°F. The UCS/ESA study also finds that Texas will experience accelerated sea level rise, lower groundwater availability and intensified weather events like droughts and floods.

The root cause of global warming is the growing amount of greenhouse gases emitted into the atmosphere.

Climate models project that the summertime heat index (which combines the effects of heat and humidity into an effective temperature) will increase between 10°F to 25°F in Texas. If the projected rise in heat index were to occur, summertime conditions for Houston could become like those experienced in Panama (115°+).

Texas Greenhouse Gas Emissions from Fossil Fuels (1990-1999)
Totals per Year - in million metric tons carbon equivalent (MMTCE)



Greenhouse gas emissions in Texas are the highest in the nation. In fact, if Texas were an independent nation, it would rank seventh in the world in carbon dioxide emissions.

Fortunately, studies have shown that Texas can be a leader in the solutions to global warming. A Tellus Institute study for the World Wildlife Fund shows that aggressive policies can cut GHGs 34 percent in 10 years compared to business as usual. These policies will also create a net 84,000 jobs and save the average consumer \$200-\$700 in annual energy bills (Tellus, 2000).

The Greenhouse Effect

The earth is inhabitable because of the greenhouse effect – the insulating effect of atmospheric gases that keeps the earth some 60°F warmer than it would be otherwise. While most GHGs, such as carbon dioxide, methane and nitrous oxide, are present in the atmosphere as a result of natural processes, human activity has increased the emissions of these gases into the atmosphere. Other GHGs – such as halocarbons do not occur naturally and are purely of human origin. **As a result of increases in all of these emissions, the atmospheric concentrations of GHGs have increased, enhancing the natural**

greenhouse effect, and bringing with it more warming.

The gases of greatest concern are carbon dioxide, methane, nitrous oxide, and halocarbons. Carbon dioxide, which is produced primarily through burning gasoline, natural gas, coal, and oil, is the largest contributor to the greenhouse effect (82 percent nationwide).

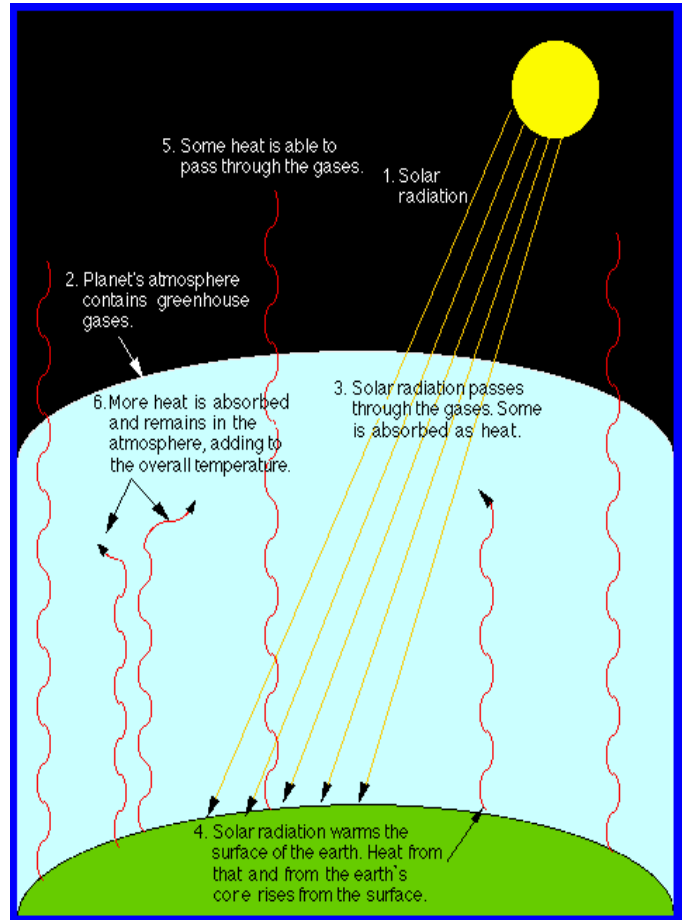
Methane, which is over 20 times more potent than carbon dioxide, accounts for just under 10 percent of US emissions and result from decomposing landfill waste, manure and fermentation from livestock and natural gas systems.

Nitrous oxide emissions are six percent of US GHG emissions and arise from agricultural soil management and combustion engines. Halocarbons, which include chlorofluorocarbons, hydrochlorofluorocarbons, and perfluorocarbons, are typically produced during industrial processes (US EPA, 2001).

Global Warming Potentials

The Global Warming Potential (GWP) is a measure that quantifies the relative climate forcing impacts of various GHGs. It is defined as the cumulative climate forcing over a specified time horizon relative to some reference gas.

The Greenhouse Effect



Source: University of Michigan

The reference gas used in the chart below is carbon dioxide. According to the International Panel on Climate Change (IPCC) GWPs typically have an uncertainty of ± 35 percent.

Greenhouse Gases And Their Sources			
Greenhouse Gas	Source	Life Span In Atmosphere	Global Warming Potential
Carbon dioxide (CO ₂)	Fossil fuels, deforestation, soil destruction	Up to 200 years	1
Methane (CH ₄)	Cattle, biomass, rice paddies, gas leaks, mining, termites	14 years	21
Nitrous oxide (N ₂ O)	Fossil fuels, refineries, soil cultivation, deforestation	114 years	310
Chlorofluorocarbons (CFCs 11 and 12)	Refrigeration, air conditioning, aerosols, foam blowing, solvents	45 years	2000-3000
Ozone and other trace gases	Photochemical processes, cars, refineries, power plants	Hours to days in upper troposphere	Difficult to trace

Source: International Panel on Climate Change. 2001.

Global Warming Science

Addressing the challenges of global warming requires understanding the natural and human forces that drive climate. In the last decade, significant gains have been made in developing a rigorous scientific understanding of global warming.

The International Panel On Climate Change (IPCC)

To provide a scientifically sound basis for global warming policymaking, the United Nations Environment Programme and the World Meteorological Organization in 1988 established an international team of scientists to review and assess the state of global warming science. This team, the International Panel on Climate Change (IPCC), has since published three comprehensive assessments (in 1990, 1996 and 2001) and several more narrowly focused assessments, all based on extensive reviews of published and peer-reviewed research on all aspects of global warming.

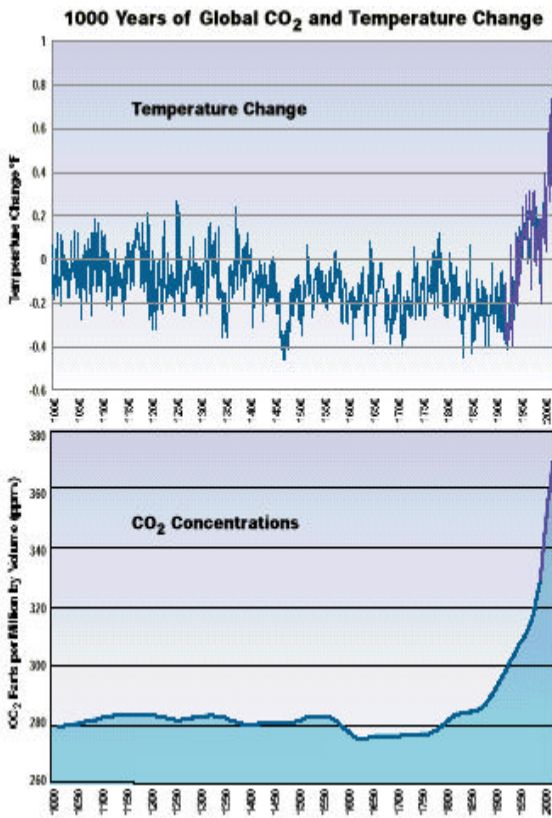
The multi-year assessments are conducted by thousands of global warming experts – natural and social scientists, economists, and industry and nongovernmental experts on various aspects of global warming – from more than 100 countries. Each assessment undergoes an extensive multistage process of scientific peer review and finally a governmental review to generate what is widely recognized as the most comprehensive and credible evaluation of the state of global warming science. A joint statement by 16 national academies of science and a separate statement by the US National Academy of Sciences recognized the IPCC technical assessments as the most objective and comprehensive overviews of global warming science.

The scientific consensus that emerged from the IPCC process is that the global average temperature has risen by about 1° Fahrenheit over the past 140 years, and the average could rise by another 2.5° to 10.4° Fahrenheit by the end of the 21st century if greenhouse-gas emissions are not dramatically reduced. Other observed changes in the global climate such as increased rainfall and more extreme rainfall events, along with observed impacts of global warming led the IPCC to conclude that these events create “a collective picture of a warming world that is already seeing the first signs of changing climate.” The panel also found evidence of a human role in this change, concluding that human emissions of greenhouse gases “have contributed substantially to the observed warming over the last 50 years” (IPCC 2001).

US National Academy Of Sciences (NAS)

In a June 2001 report requested by the Bush administration, a committee of the National Academies' National Research Council summed up science's current understanding of global warming and examined what may be in store for the 21st century. The committee, made up of 11 of the nation's top climate scientists – one of whom is a Nobel-Prize winner – found that the IPCC conclusion that global warming has occurred in the last 50 years is likely the result of increases in greenhouse gases accurately reflects the current thinking of the scientific community.

In December 2001, the NAS released a study that found dramatic shifts in climate (up to 18 degree in one decade) have occurred in the past and "abrupt climate changes were especially common when the climate system was forced to change most rapidly." The NAS concluded, “thus, greenhouse warming and other human alterations of the earth system may increase the possibility of large, abrupt and unwelcome regional or global climatic events” (NRC, 2001).



Source: US Global Change Research Program, 2000.

The Planet is Warming

The scientific record from global temperature readings over the last century leaves no doubt that the earth is

October 2001 was the warmest October ever on historical record (1880-present)

warming. Surface temperatures have risen about 1.0°F in 100 years. The 1990's was the warmest decade of the last century, and 1998, 1999, and 2000 were three of the hottest years on record.

Expected Impacts of Climate Change

The latest findings by the IPCC project that precipitation patterns will change – including the frequency of extreme events like floods and droughts. As a result, water supply and demand are

likely to change. Sea-level rise will add to stresses coastal communities already face, including erosion and storm damage. Natural ecosystems – already facing human-caused stresses such as habitat destruction and species loss – may not be able to adapt fast enough to keep up with a rapidly changing climate.

The latest IPCC report also strengthened its conclusion about the role of human activities and global warming, finding that human-generated emissions “have contributed substantially to the observed warming over the last 50 years.”

Texas and Global Warming

In 1991, legislative leaders in Texas assembled the Joint Select Committee on Toxic Air Emissions and the Greenhouse Effect to study the statewide effects of global warming and prudent responses. After months of testimony and research, the committee's final interim report to the 72nd Legislature predicted how climate change could:

- Increase storm activity
- Increase coastal erosion
- Threaten coastal fisheries
- Increase drought conditions and threaten water supplies
- Increase the duration and severity of heat spells

Since 1991, several statewide studies have supported the committee's findings utilizing more sophisticated models. **Today, a decade after the committee's report, Texas has failed to develop a statewide action plan to address global warming.** Yet, over half

of US states have developed their own plans.

The latest statewide study by the Union of Concerned Scientists and the Ecological Society of America finds that in the next 100 years, summer temperatures in Texas could increase by 3-7°F and minimum winter temperatures could increase from 3°F to about 10°F. The UCS/ESA study also finds that the Texas gulf coast will experience accelerated sea level rise, lower groundwater availability and intensified weather events like droughts and floods.

Texas Greenhouse Gas Emissions

The root cause of global warming is the growing amount of greenhouse gases emitted into the atmosphere.

Greenhouse gas emissions in Texas are the highest in the nation. In fact, if Texas was its own separate country, it would rank seventh in the world in carbon dioxide emissions.

Greenhouse gas emissions are closely linked to energy consumption. In 1999, Texans consumed about 11.5 quadrillion British Thermal Units (Quad BTU's) of fuels and electricity to meet their demands in residential and commercial buildings, industry and transportation. This represents over 12 percent of

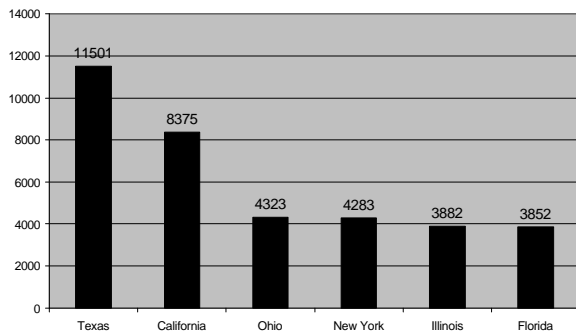
national energy consumption. Since the Texas population is about seven percent of the national population, its energy use per capita is about 60 percent higher than the national energy intensity.

Texas electricity generation is dominated by natural gas and coal (48 and 38 percent respectively), with nuclear at about 10 percent. In the US about one half of electricity is produced by coal, about 20 percent by nuclear energy (US EPA, 2001).

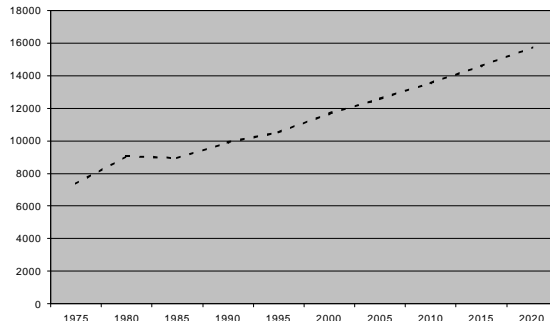
Texas carbon dioxide emissions reflect its overall energy use and fuel mix, about 164 million metric tons of carbon equivalent (MMTCE) in 1999, over 9 percent of total national emissions of 1840 MMTCE. Thus, Texas emits about 8.2 MMTCE per capita, well above the nation's approximately 6.5 MMTCE per capita. Between 1990 and 1999, total greenhouse gas emissions in Texas increased from 149 million metric tons of carbon equivalent (MMTCE) to 164 MMTCE, a rise of 11 percent. (US EPA, 2001)

The overall energy use in Texas is projected to increase by 36 percent over the next 20 years, a growth rate of 1.5 percent per year. Unless Texas significantly alters its fuel mix towards lower emitting fossil fuels or renewable energy, greenhouse gas emissions are expected to continue to rise rapidly.

Energy Consumption: State Rankings (1999)
(Trillion Btu's)



Projected Texas Energy Consumption to 2020
(Trillion BTUs)



Dallas/Fort Worth

Current scientific research indicates that global warming poses significant risks to the Dallas/Fort Worth area.

Water

Water is becoming increasingly scarce and expensive, independent of global warming. Texas water demands are growing with population, incomes, and an appreciation for the values of ecological and recreational uses. Climate models estimate that a warmer, drier climate would lead to greater evaporation, as much as 35 percent decrease in streamflow to the coast and less water for recharging groundwater aquifers.

A study for the Trinity River projects that in a period of severe drought like the 1950's, global warming in the next century could drop municipal reservoir levels to 22 percent capacity. This global warming-aggravated drought of the future could drop power reservoir levels to 40 percent capacity (Schmandt, 1995).

Human Health

Mortality from heat waves has been projected to increase under most scenarios of global warming. The increase in heat-related mortality rates will be determined by the frequency of extreme heat waves as well as the ability to implement early warning systems and other interventions that focus on at-risk populations. **One study projects that by 2050 heat-related deaths in Dallas/Fort Worth during a typical summer could triple, from about 35 heat-related deaths per summer to over 100. (US EPA, 1997)**

Region Profile -East Central-



Population (2000) – 6,413,288

Significant sources of greenhouse gases:

- Electric Utilities
- Livestock/Landfills
- Transportation

Hot Spots

22-40% decrease in reservoir levels

Heat related deaths could triple by 2050 (From 35 to over 100).

Days over 100°F could rise from 19 to 78 over the next century.



Global warming may affect human respiratory health by changing levels of air pollutants and pollens. Higher temperatures lead to increased production of ground-level ozone and smog, exacerbating asthma and other respiratory diseases. This will further strain urban areas like Dallas/Fort Worth in meeting federal air quality standards.

The risk of water-borne illnesses can increase with warmer temperatures and extreme rainfall and runoff. Thus, gastrointestinal diseases, respiratory diseases and skin, ear and eye infections are expected to place a greater burden on the public health system in the future.

Houston/Galveston

The Texas coastline is especially vulnerable to global warming due to its unique topography, ecology and economic development.

Sea Level Rise

Global warming is likely to accelerate the historical rise in sea level through warming of oceans and melting of ice, which in turn will affect coastal development, wetland resources, and recreation along the Texas coast. The impacts of sea-level rise will occur in coastal areas that are continually evolving and already face a wide range of natural and human-induced stresses, including erosion, storms, land subsidence, wetland loss, and environmental degradation from recreation and development pressures.

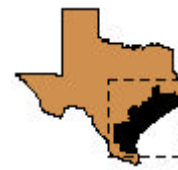
Recent studies project a 17-inch sea level rise in the Houston-Galveston area over the next century. This sea level rise will aggravate groundwater contamination by intruding saltwater and make necessary additional protective barriers such as seawalls that cost about \$7 million per mile (Schmandt, 1995). The US EPA estimates that the cumulative cost of sand replenishment to protect the coast of Texas from a 20-inch sea level rise by 2100 is estimated to cost as much as \$12.8 billion.

Air Quality

Houston, the fourth largest city in the US, is virtually tied with Los Angeles as the smoggiest cities in the nation.

Projected high temperatures from global warming would enhance the formation of ground-level ozone and other toxic chemicals associated with smog. Global warming is expected to

Region Profile -Gulf Coast-



Population (2000) - 5,972,461

Significant sources of greenhouse gases:

- Petroleum Refining
- Electric Utilities
- Transportation

Hot Spots

Higher Temperatures to 115°F heat index

25% reduction in Brown Shrimp catch

Increased smog levels

17-inch higher sea levels



increase the length of the already long smog season in Texas.

Ecosystems

Changes in rainfall and runoff from upland regions coupled with sea level rise would accelerate the loss of coastal wetlands and estuaries thus threatening Texas' natural habitats as well as tourist destinations. **Studies show that vital coastal industries like brown shrimp could experience losses of 25 percent over the next century.**

Lubbock/High Plains

The linkages between agriculture and climate are pronounced and critical. Current global warming models indicate that crop yields in warm, low-latitude regions of the southern United States like the Texas panhandle are likely to decline over the next century.

Agricultural systems are very sensitive to extreme climatic events such as wind storms, droughts, and to seasonal variability such as changing rainfall patterns. **Global warming could accelerate the frequency and magnitude of extreme weather events and could change seasonal patterns in unfavorable ways for the Texas high plains region.**


Increases in rainfall intensity pose a threat to agriculture and the environment because heavy rainfall is primarily responsible for soil erosion, leaching of agricultural chemicals, and run-off that carries livestock waste and nutrients into water bodies. **Global warming is also expected to have a number of negative indirect effects on agricultural systems, such as incidence and distribution of pests and disease and increased rates of soil degradation.**

Water

The availability of freshwater to meet the demands of an increasingly affluent population while sustaining a healthy environment has emerged as one of the Texas' primary resource issues.

The Texas panhandle accounts for 70 percent of the groundwater withdrawal

**Region Profile
-Panhandle Plains-**

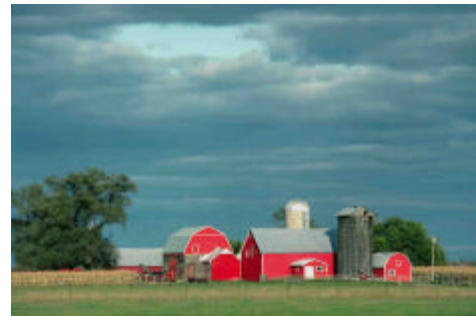


Population (2000) - 1,100,823

Significant sources of greenhouse gases:

- Electric Utilities
- Carbon Black Manufacturing
- Natural gas production

Hot Spots
Increased water demands
Changes in crop patterns
Increased incidence of agriculturally harmful pests



of the entire state, predominantly for agriculture. Texas panhandle concerns about water for municipal and agricultural use revolve around the capacity of the Ogallala Aquifer. **As a finite resource with little recharge, the Ogallala is expected to be drawn down at a faster pace with an increased demand for irrigation under global warming.**

San Antonio/Austin

Global warming will further challenge south central Texas' rapid development and expanding population.

Water

South central Texas' water supply is especially vulnerable to global warming as an increase in temperature will cause an **increase for water demand in irrigation and municipal use, but will also increase evaporation and decrease the Edwards Aquifer recharge.**

A study conducted by the American Society of Civil Engineers for the US EPA found that global warming is likely to exacerbate the water resource problems that already exist in the area. **Specifically, the authors warn, "if there is continued groundwater depletion, you will see degraded water quality and the possible extermination of four or five endangered species" (ASCE, 1998).**

Climate Extremes

Studies suggest that there will be a more unstable atmosphere in the future, which will probably result in more frequent heavy rainfalls and possibly increased hail and tornado risk. Extended periods of droughts are also projected for this region

Increased severity of heat waves may lead to an increase in illness and death, particularly among the young, the elderly, the poor, the frail and the ill.

Climate models project a higher frequency of intense rain events like the 1999 20 inch-one day deluge in San Antonio. Intense rainfall events often exceed the recharge rates of aquifers.

Region Profile -South Central-



Population (2000) – 3,252,913

Significant sources of greenhouse gases:

- Electric Utilities
- Transportation

Hot Spots

Days over 100°F could increase six-fold.

Decreased aquifer recharge

Increased flooding

Wildlife

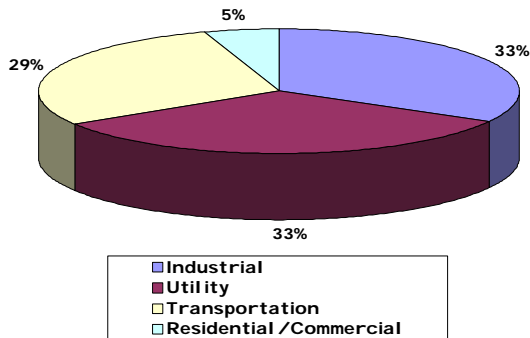
Warmer, drier conditions and reduced summer soil moisture are projected to adversely affect protected wildlife in south central Texas. Critical habitat loss for two endangered songbirds, the golden cheeked warbler and the black-capped vireo are expected.



Global Warming: Texas Solutions to a Texas-Sized Problem

According to a 2000 study by the Tellus Institute for the World Wildlife Fund, money-saving energy policies could significantly cut greenhouse gas emissions in Texas. These policies are projected to create a net 84,000 new jobs for Texans, while saving the average family \$200 to \$700 per year. The foundations of meeting the global warming challenge in Texas are cooler power sources, cooler cars and cooler industry.

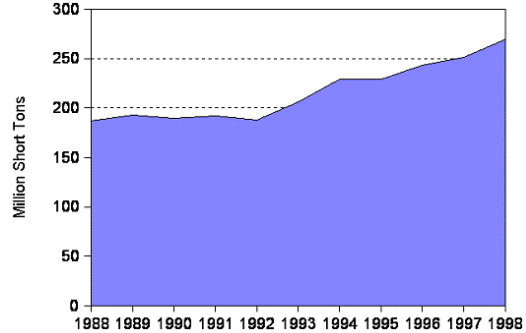
Texas Greenhouse Gas Emissions By Sector



Dirty vs. Clean Energy

Few Texans realize that even today much of our electricity comes from dirty, heavily polluting, coal-fired power plants. In fact, fossil fuels -- coal, oil, and natural gas -- account for over 85 percent of fuel use in Texas. These power plants release 263 million tons of global warming pollution into Texas air each year (US EPA 2001). They also contribute to numerous other pollution problems, including acid rain and smog. In Texas, fossil fuel power plants produce about one-third of all greenhouse gas emissions. While producing electricity, these plants function as global warming machines,

Texas Carbon Dioxide Emissions From Electricity Generation 1988-1998

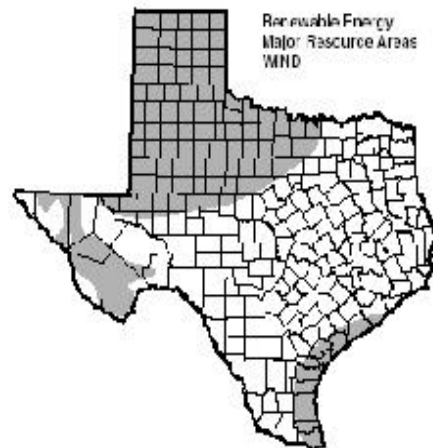


steadily altering the climate of the planet.

There are viable alternatives to fossil fuel. Clean renewable energy from the sun and wind offer non-polluting, economical, and durable alternatives for generating electricity. In fact, Texas leads the nation in the ability to generate electricity with renewable energy.

Wind

Wind turbines are now producing competitively priced commercial quantities of electricity. Wind turbines, usually with just two or three blades, collect kinetic energy from the wind,



which drives a generator and produces electricity. Texas has more windy areas than any other state. The Panhandle and Gulf Coast regions are especially well suited for wind power. If wind turbines were placed on just 4,000 square miles of Texas land, they would generate 280 million megawatt hours per year (enough to supply all the state's electricity needs).

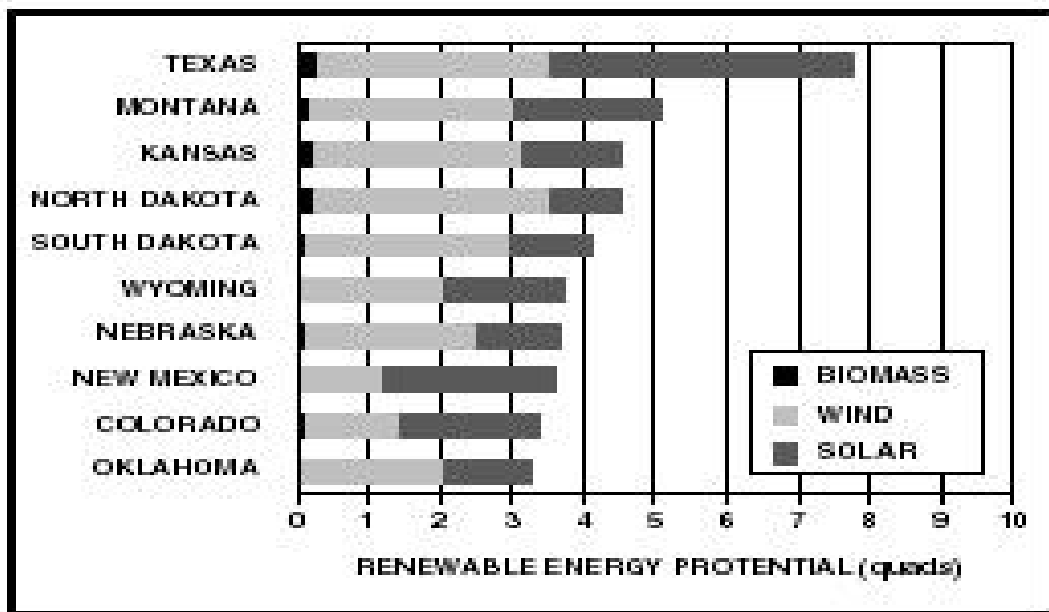
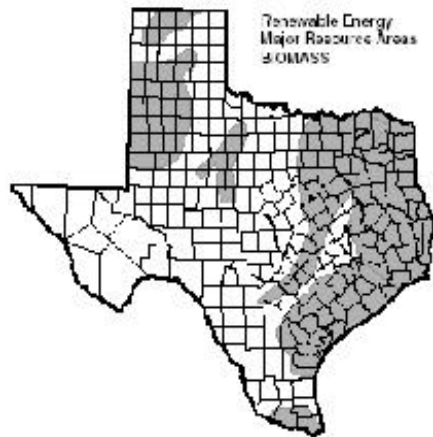
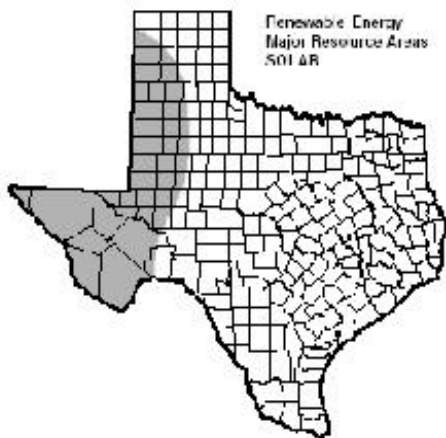
Solar

Solar energy can be directly converted into usable energy through a variety of processes -- solar water heating, passive solar heating and cooling, photovoltaic

technology, and solar thermal technology. Texas' best solar energy sites are located in West Texas where one acre of land can produce the equivalent of 800 barrels of oil a year.

Biomass

Biomass uses energy crops like fast growing trees, industrial wood waste, organic landfill waste or landfill gas to generate electricity. East Texas and parts of north and central Texas are ideal growing locations for biomass resources. Biomass energy could provide the energy equivalent of 200 million megawatt-hours annually.



Energy Efficiency

While widespread use of renewable energy sources may be a few years away, there are a number of global warming solutions that can be put to use today.

Texans can take many steps to use energy more efficiently and curb global warming. During the last two decades, energy efficiency technology has improved much faster than it has been adopted. It is now possible to displace about half of all energy consumption for less money than is currently spent to use it. Some products, such as fluorescent lights and refrigerators, have been improved by federal standards, but in many areas appliances and electronics continue to waste enormous amounts of energy.

An excellent example of energy efficiency potential is light bulbs, which most consumers are still using lights based on 100-year-old incandescent technology. A compact fluorescent light bulb that uses 16 watts of electricity puts out as much light as a conventional bulb that uses 60 watts. Over its life, one compact fluorescent light bulb can prevent 400 pounds of coal from being burned to produce electricity, and save two to four times its purchase price, depending on what price is paid for electricity.

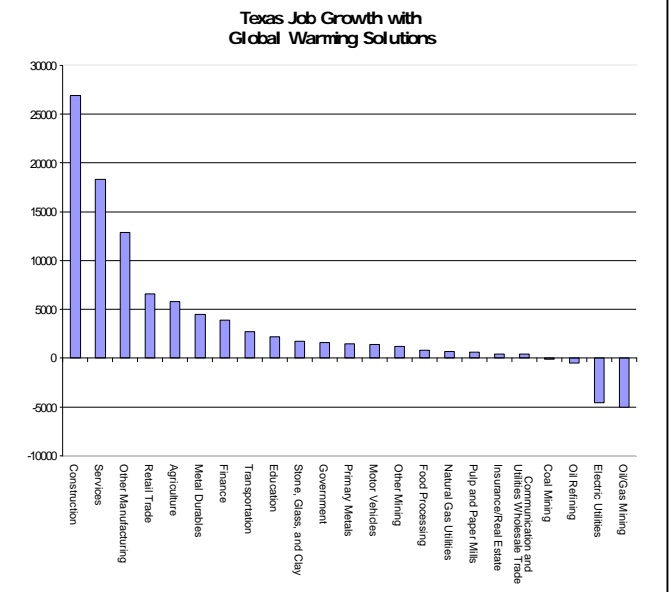


Improved energy efficiency in Texas makes both environmental and economic sense. Efficiency helps promote sustained economic growth by making the economy less vulnerable to the boom-and-bust cycle. Improvements in efficiency and cost savings to industrial, business and residential consumers increase competitiveness and lower the cost of production.

A recent study by the Tell us Institute for the World Wildlife Fund found that Texas leads the nation in job creation potential under global warming "solutions" scenarios.

The study concluded that solutions to global warming in Texas over the next decade could produce:

- **A net 84,000 new jobs**
- **Annual savings of \$200-700 for the typical Texas consumer**
- **Average annual wage and salary earnings in Texas would increase about \$3 billion**
- **An expansion of gross state product by \$2 billion**



Global Warming and Transportation

Motor vehicles produce a significant amount of greenhouse gases. Transportation greenhouse gas emissions are primarily carbon dioxide, however vehicles also emit nitrogen oxides that contribute to ground level ozone – or smog. In 1999, Texas consumed 240 million barrels of motor gasoline, putting it second only to California. As a result, Texas emitted 48 million metric tons carbon equivalent (MMTCE). This amount represents approximately 30 percent of statewide greenhouse gas emissions.

Texas can take action on transportation greenhouse gas emissions by improving fuel efficiency, promote changes in vehicle use (such as carpooling and mass transit), telecommuting and shifting to non-oil based fuels such as biomass.

Currently, the top selling vehicles in Texas are light duty trucks and sport utility vehicles (SUVs). As larger vehicles become more popular, it is ever more important to improve vehicle fuel efficiency.

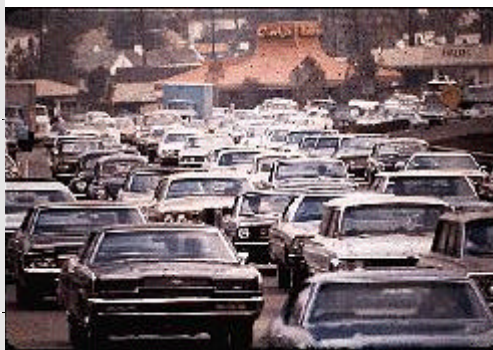
According to a 2001 Union of Concerned Scientists (UCS) report, SUVs emit 43 percent more global warming pollution than an average car and consume far more gasoline. While a 14-mile per gallon SUV emits more than 130 tons of carbon dioxide over its lifetime, the average new car emits 74 tons. Alternatively, more efficient hybrid vehicles are available today. Honda and Toyota have developed competitively priced gasoline-electric hybrid cars that get 45-60 mpg and emit only a quarter of the average car's global warming pollution over its lifetime. The State of Texas can help promote these cleaner technologies and "lead by example" by converting state agency vehicle fleets to high mileage, low carbon emitting vehicles.

State and local governments can redesign communities to encourage walking, biking, and mass transit can to cut greenhouse gas emissions. Providing incentives for mass transit and carpooling can provide the public with cleaner transportation alternatives.

Alternative fuel sources like ethanol can help reduce transportation greenhouse gas emissions. A University of California, Davis study found that ethanol is over twice as clean as traditional reformulated gasoline in greenhouse gas emissions. Some countries, like Brazil, have chosen to make most of their motor fuel from less-polluting sources like biomass. Fuels made from renewable resources have a further greenhouse emissions advantage over those based on nonrenewable resources, because the regrowth of feedstocks recaptures the carbon dioxide released by combustion of the fuel. As the nationwide leader state in biomass potential, Texas can promote rural areas of Texas and help the environment by encouraging the use of these products.

CAFE Standards

One of the biggest steps the United States can take to curb global warming, save consumers money at the gas pump and conserve oil is to adopt higher miles per gallon standards for cars and light trucks. In 1975, Congress passed and President Ford signed into law Corporate Average Fuel Economy (CAFE) standards in an effort to reduce US dependence on foreign oil. By requiring that new cars average 27.5 miles per gallon (mpg) and light trucks, including SUVs, minivans and pickups, average 20.7 mpg, these standards currently save 3 million barrels of oil every day. Due to the recent rise in popularity of SUVs, the overall fuel economy of passenger vehicles is in decline. UCS estimates that raising the miles per gallon standards for light trucks to 27.5 mpg would save Texans a total \$3,617 million at the gas pump by 2012 - with more savings to follow. Texans can turn to EPA's comprehensive guide to "green cars" at <http://www.epa.gov/autoemissions/>



How Can Individuals Cool Texas?

Every Texan can take action on global warming. In many cases, a little change in lifestyle and behavior can produce big changes in GHG reductions. The greatest potential individual GHG reductions are found in the home and in transportation.

Powering the average house is responsible for six-times more air pollution and carbon dioxide emissions than is the average car. GHG reductions can be achieved through purchasing energy-efficient appliances, fixtures, and other home equipment and products that have further benefits of cutting household utility bills. Appliances with the US EPA's ENERGY STAR label have been shown to save 40 percent of a household's energy bill. These products are required to exceed minimum federal standards for energy consumption by 13 to 40 percent.

The most important household step consumers can take is purchasing renewable energy from utility providers. Renewable energy can provide power at stable prices while avoiding harmful emissions from fossil fuel sources.

GHG emissions can be cut dramatically by using mass transit, combining trips or simply by walking/bicycling instead of driving. Carpooling and operating high fuel efficiency vehicles can also cut GHG emissions.

The US EPA estimates that every gallon of gas burned by a vehicle releases 20 pounds of carbon dioxide to the atmosphere.

Texans can also reduce greenhouse gas emissions through extending the life of resources by recycling. According to the US EPA, recycling aluminum cans, glass bottles, plastic, cardboard, and newspapers can reduce household carbon dioxide emissions by 850 pounds per year.

Texans can estimate their personal GHG emissions and possible reductions through the EPA's GHG calculator at: http://www.epa.gov/globalwarming/tools/ghg_calc.html. Texans must take action at the personal, corporate and civil levels to increase awareness of the consequences of and the solutions to global warming. The following pages outline actions that you can take to cool Texas.

10 Ways to Cool Texas -Individuals-

1. Switch to a renewable energy provider.....Saves 25,600 lbs. of CO₂/year
2. Buy a vehicle that averages 10 mpg more than your present vehicle.....Saves 7,000 lbs. of CO₂/year
3. Avoid driving 25 miles a week by carpooling or taking mass transit.....Saves 1,500 lbs. of CO₂/year
4. Switch to a four day ten hour work schedule.....Saves 2,000 lbs. of CO₂/year
5. Insulate a water heater and turns its thermostat down to 120.....Saves 1,500 lbs. of CO₂/year
6. Replace 10 60-watt conventional light bulbs with compact fluorescents...Saves 1,500 lbs. of CO₂/year
7. Replace an old refrigerator with an ENERGY STAR model.....Saves 1,700 lbs. of CO₂/year
8. Replace an old air conditioner with an ENERGY STAR model.....Saves 3,300 lbs. of CO₂/year
9. Recycle half of potentially recyclable materials (paper, glass, plastic).....Saves 3,900 lbs. of CO₂/year
10. Educate others on the impacts of global warming and the actions they can take to help "cool Texas."

How Can Businesses Cool Texas?

A growing number of companies have adopted climate-related targets, such as energy efficiency and greenhouse gas emissions. Many of the companies see targets as improving their competitive market position by reducing production costs and enhancing product sales today, and in anticipation of regulatory and market environments of the future.

Companies doing business in Texas can demonstrate their commitment to mitigating global warming by setting targets for greenhouse gas emissions reductions. Three ways Texas businesses can meet greenhouse gas reduction targets are cleaner energy, improved manufacturing processes and conservation and better waste management practices.

Burning fossil fuels to provide energy contributes significantly to greenhouse gas emissions. Energy providers can reduce greenhouse gas emissions in fuel production and electricity generation. These energy providers can develop technology and renewable energy sources in the interest of a cleaner energy supply. BP committed in 1997 to reduce GHG emissions 10 percent below 1990 levels by 2010. DuPont will reduce GHG emissions 65 percent below 1990 levels by 2010, hold total energy use flat using 1990 as a base year, and meet 10 percent of global energy needs from renewable resources by 2010.

Businesses can reduce their energy demand by improving their manufacturing processes, conserving energy, promoting energy efficiency and purchasing renewable energy for use within their business operations. American Electric Power has upgraded lighting over 6.5 million square feet, avoiding 30,000 tons of carbon dioxide emissions per year. IBM's energy conservation efforts in 2000 reduced total energy use by almost 4.8 percent, avoiding an estimated 162,000 tons of carbon dioxide emissions while saving the company more than \$14.7 million.

Businesses in Texas can also reduce GHG emissions by improving their waste management practices. These emission reductions result from decreased landfill gas production and less need to extract and process raw materials.

Ten Ways to Cool Texas -Businesses-

1. Create an inventory of company-wide GHG emissions.
2. Implement GHG reduction strategies.
3. Establish internal awards to recognize environmental leadership among staff.
4. Establish energy conservation measures like efficient lighting, heating and cooling systems.
5. Buy high efficiency products like ENERGY STAR copiers, computers etc.
6. Establish a comprehensive waste reduction policy that encourages recycling all possible materials.
7. Change business utility provider to renewable energy.
8. Offer employee transit passes.
9. Convert fleet vehicles to run on alternative fuels.
10. Plant trees to cool buildings and take other steps installing white roofs and parking surfaces to cool the urban heat island effect.

How Can Cities and Counties Cool Texas?

Climate scientists anticipate global warming to seriously affect cities and urban areas. Regional temperature increases will create more smog. Changes in precipitation will adversely affect urban water supplies. An increase in extreme weather events will cause damage to urban infrastructure; and sea level rise will eventually inundate infrastructure and settlements in many coastal cities.

Local governments can influence many of the activities that produce greenhouse gas emissions. Areas where local governments can make significant GHG reductions are:

- The operation of municipal buildings, street lighting, recreational facilities
- Building codes and energy efficiency permits
- Landfill sites
- Waste management programs such as recycling or composting
- Land use planning and development
- Transportation infrastructure

Portland, Oregon has developed its own global warming action plan that aims to reduce area greenhouse gas emissions 20 percent from 1988 levels by 2010. These reduction actions complement other economic and environmental goals, thus enhancing the city's livability.

10 Ways to Cool Texas -Cities and Counties-

1. Conduct a city or countywide greenhouse gas emissions inventory.
2. Establish an emissions target.
3. Develop a local action plan.
4. Buy high efficiency products like ENERGY STAR Copiers, fax machines, computers, scanners, exit signs, heating and cooling products, windows, and other equipment for municipal use.
5. Switch from fossil fuel-generated electricity to renewable-based power in municipal buildings.
6. Convert fleet vehicles to run on alternative fuels.
7. Implement curbside recycling.
8. Buy products from recycled material.
9. Capture methane from landfills.
10. Plant trees to cool buildings and take other steps installing white roofs and parking surfaces to cool the urban heat island effect.

How Can The Texas Natural Resource Conservation Commission (TNRCC) Cool Texas?

In 2000, environmental groups petitioned the TNRCC to develop rules that would reduce GHGs in Texas. As a result, the TNRCC is conducting its first-ever statewide global warming report with recommendations to be released on January 18, 2002. Strong recommendations to reduce GHGs would provide the foundation for a comprehensive statewide global warming action plan.

Action at the state environmental agency level is a key component of the Texas response to global warming. The Texas Natural Resource Conservation Commission has the specific authority to regulate some of the largest contributors to global warming in the state.

The TNRCC can develop a global warming action plan that contains actions to reduce climate change in Texas. Currently, 25 states and Puerto Rico have initiated state action plans and nineteen have completed them. Five of the state plans alone have identified strategies that could collectively reduce greenhouse gas emissions by 34 million metric tons carbon equivalent (MMTCE), or 2 percent of the US 2010 emissions, while saving over \$600 million per year. By taking a proactive approach to planning GHG emissions reductions, the TNRCC can serve as an example to state government, businesses and citizens of Texas.

Ten Ways to Cool Texas -TNRCC-

1. Adopt and implement a plan to reduce Texas' greenhouse gas emissions that meets the targets the U.S. agreed to in 1990 like eight Northeastern states have already done. Set target and plan for long-term (2050) climate stability (60-70 percent GHG reductions).
2. Require companies to report GHG emissions to TNRCC.
3. Collect, organize and display information about companies' GHG emissions on a plant by plant basis so the public can see where the gases come from, and what progress companies are making in reducing their emissions.
4. Assure state incentive programs for clean cars and trucks are linked to lower GHG emissions.
5. Make greenhouse gas-reducing controls like carbon sinks a requirement for industrial plants to get state permits.
6. Require methane reductions from pipelines, refineries, garbage dumps and confined animal feeding operations.
7. Give businesses emissions credits for energy efficiency and on-site renewables.
8. Give businesses emissions credits for purchases of renewable energy.
9. Develop fuel cells for tomorrow's transportation needs.
10. Require the use of ethanol from agricultural waste or other agricultural products as Texas fuel oxygenate (25 percent by 2005).

How Can the Governor Cool Texas?

The Governor of Texas can provide leadership on global warming through agenda setting and the specific authority of executive order. Action on global warming at state Governor's offices is not new. In June 2001, the Governor of New York, George Pataki (R) initiated three significant measures:

- New York State Greenhouse Gas Task Force to develop policy recommendations for reducing greenhouse gas emissions.
- Signed an executive order that requires state agencies to implement energy efficient practices and increase purchases of energy efficiency products.
- Called on the federal government to take action on greenhouse gas emissions in multi-pollutant power plant clean up legislation.

In August 2001, six New England Governors – three Democrats, two Republicans, one Independent - in concert with the Eastern Canadian Premiers produced a regional global warming action plan that calls for the states and provinces to work together to reduce greenhouse gas emissions by cutting emissions from power plants, increasing the use of renewable energy sources, and promoting energy efficiency and conservation. The short-term goal of the global warming pact is to reduce regional greenhouse gas emissions to 1990 levels by 2010 and by 10 percent below 1990 levels by 2020. The long-term goal is to reduce emissions to a level that eliminates any dangerous threats to the climate - a goal scientists suggest will require reducing emissions to 60 or 70 percent below current levels.

10 Ways to Cool Texas -Governor-

1. Commit to a 25% reduction in energy use for all agencies by 2005.
2. Have all state agencies buy renewable energy – 10% by 2005, 20% by 2007, and 100% by 2010.
3. Require ENERGY STAR energy efficient products when replacing existing state agency equipment.
4. Conduct a biannual report on the states GHG emissions.
5. By 2005, require at least 50 percent of new state light-duty vehicles operate on alternative fuel or hybrid electric.
6. Require state employees to work 10-hour 4-day work schedules. This cuts 20% of employee trips and allows the public greater access to staff at times they are off work.
7. Ask all state investment funds to do a carbon risk analysis and take steps to reduce their at-risk holdings.
8. Ask all state agencies to review global warming vulnerabilities and plan for mitigation.
9. Order 10% of states workforce to telecommute and create regional and local conferencing centers so that the public can attend meetings and hearings without driving to Austin.
10. Prepare a guidance document that contains the best GHG reduction practices within state and federal agencies.

How Can the State Legislature Cool Texas?

The Texas Legislature has recognized global warming as a threat since 1991. Many states are enacting new state laws to achieve greenhouse gas reductions while simultaneously addressing energy, air pollution, agricultural and transportation issues. State initiatives generally fall under three categories; implementing direct regulations, providing financial incentives and providing information and education.

States can mitigate global warming by setting numeric goals for reducing GHG emissions. New Jersey has committed to reduce GHG emissions to 3.5 percent below 1990 levels by 2005. Though legislation, Massachusetts recently capped carbon dioxide emissions from its six highest-emitting power plants. Oregon enacted a law in 1997 establishing carbon dioxide standards for new power plants.

State laws can enhance statewide energy efficiency and the use of renewable energy through incentives. Recent California energy conservation legislation dedicates over \$800 million to conservation initiatives and incentives. Maryland provides tax incentives to residents and businesses for purchases and investments in clean energy technology and consumer products. States can also establish incentives for renewable energy. Indiana provides grants of up to \$10,000 to businesses, not-profits, and local governments to cover the incremental cost of renewable energy projects. Over half of US states provide incentives for renewable energy development.

Through statewide education programs, Texas can inform the public about the threat of global warming and the part individuals and businesses can play in dealing with the problem. Information dissemination programs may include public education campaigns, the provision of information through technical reports, publicity around voluntary standards, public service announcements and support for research and development. Alabama, Montana, New Hampshire, Tennessee and Wisconsin are just a few of the states that have global warming education programs.

Ten Ways to Cool Texas --State Legislature--

1. Create a working group to conduct a risk assessment of the potential consequences of global warming for Texas in terms of financial losses from global warming related health, property and liability insurance losses.
2. Cap carbon dioxide emissions from power plants in Texas.
3. Pass legislation that establishes a carbon dioxide standard requiring new facilities to emit 15% less than most energy efficient plant available. Facilities can meet the standard by directly, or paying a per-ton of carbon dioxide offset into a climate trust which purchases offsets.
4. Incorporate a Texas greenhouse gas action plan into the state's energy and water plans.
5. Increase the energy efficiency standard of growth to 25 percent for all utilities.
6. Create a revolving loan program to fund energy efficiency.
7. Increase the renewable portfolio standard to 10 percent by 2020 and 25 percent by 2050.
8. Pass biomass legislation.
9. Authorize local property tax rebates for energy efficiency and renewable energy.
10. Convert vehicle fleets to alternative fuel or hybrid electric.

Conclusion

Right now Texans have the opportunity to take major steps towards reducing the most destructive gases pouring into the earth's atmosphere – greenhouse gases. And with opportunity comes responsibility. Since Texas is seventh biggest greenhouse gas emitter in the world, Texans bear a special responsibility to the world to reduce its share of these harmful gases.

This study has gathered information from a wide variety of sources. In total, these sources determine that Texas has much to lose under a global warming future. Alternatively, it is evident that Texan's ingenuity and vast natural resources can work toward reductions in greenhouse gases today.

Texas is blessed with enormous potential in meeting the global warming challenge. Texas leads the nation in renewable energy potential. Development of the state's renewable energy resources could provide meaningful employment and stimulate economies – large and small.

Texas' opportunity in energy efficiency global warming solutions also looms large. With individual energy consumption rates at 60 percent above the national average, Texans can build a new foundation of energy efficiency that will help lower electricity bills and make our industries more competitive.

Modern science has given Texan's a glimpse of an imminent environmental threat similar to the dustbowl. This study has shown that responsible action and effective management at many levels can preserve our natural heritage for future generations. Now is the time to act on global warming in Texas, from individual households to the Governor's office opportunities abound and our future is in the balance.

References

- American Society of Civil Engineers for the Environmental Protection Agency. 1998. *Climate Change Impacts on the Water Resources of the Edwards Balcones Fault Zone Aquifer, Texas*.
- Bernow, Stephen et al, 2000. *Texas Global Warming Solutions*. Tellus Institute for the World Wildlife Fund.
- Committee on Abrupt Climate Change, Ocean Studies Board, Polar Research Board, Board on Atmospheric Sciences and Climate, National Research Council. 2001. *Abrupt Climate Change: Inevitable Surprises*. National Academy Press.
- Contribution of Working Group II to the Third Assessment. 2001. *Climate Change 2001, Impacts, Adaptation, and Vulnerability*. Report of the International Panel on Climate Change. Cambridge University Press.
- Contribution of Working Group II to the Third Assessment. 2001. *Climate Change 2001, The Scientific Basis*. Report of the International Panel on Climate Change. Cambridge University Press.
- Energy Information Agency, 2001. *State Energy Data Report*. Washington DC: U.S. DOE.
- Energy Information Agency, 2001. *Annual Energy Outlook 2001*. Washington DC: U.S. DOE.
- Interlaboratory Working Group. 2000. Scenarios for a Clean Energy Future (Oak Ridge, TN; Oak Ridge National Laboratory and Berkeley, CA; Lawrence Berkeley National Laboratory), ORNL/CON-476 and LBNL-44029, November.
- International Council for Local Environmental Initiatives. 2001. *Climate Change and Local Governments*. Accessed at http://www.iclei.org/co2/cchange_localgov.htm
- National Assessment Synthesis Team, US Global Change Research Program, 2001. *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change: Overview Report*. Cambridge University Press.
- Schmandt, Jurgen. 1995. *The Impact of Global Warming in Texas: A Report of the Task Force on Climate Change in Texas*. University of Texas Press. Austin.
- Twilley, R.R. et al. 2001. *Confronting Climate Change in the Gulf Coast Region: Prospects for Sustaining Our Ecological Heritage*. Union of Concerned Scientists and Ecological Society of America. Cambridge, Massachusetts.
- United States Environmental Protection Agency. 2001. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1999*.

United States Environmental Protection Agency. 2001. *Electricity Generation Resource Integrated Database*.

Virtus Energy Research Associates, 1998. *Texas Energy: Past, Present and Future*. Texas General Service Commission, State Energy Conservation Office. Austin.