Global Warming

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Science of global warming
- Greenhouse gases
- Other contributors

Observed changes
- Temperature
- Other indicators

The future
- Emissions
- Global consequences
- Consequences for California

Mitigation Efforts
- Global
- State
- What you can do

The Greenhouse Effect

Hadley Centre for Climate Prediction and Research

Greenhouse Gases


Greenhouse Gases


Greenhouse Gases


Components of Radiative Forcing, 2005

Changes in Solar Irradiance

Hadley Centre for Climate Prediction and Research
Lean, 2003

Sulphur aerosols cool climate directly and indirectly

Hadley Centre for Climate Prediction and Research

Estimated burden of sulphate aerosol, in 1990s

Source: Sato et al, GISS, NASA

Cooling Effect of Volcanic Aerosols

Sato et al., GISS, NASA

Clouds

As has been the case since the first IPCC Assessment Report in 1990, probably the greatest uncertainty in future projections of climate arises from clouds and their interactions with radiation.


Climate change and the greenhouse effect © 2005, Met Office, Exeter, UK.
Observed warming

Helen Cox, 2007

Patterns of linear global temperature trends from 1979 to 2005 estimated at the surface, and for the troposphere from the surface to about 10 km altitude, from satellite records. Grey areas indicate incomplete data.

Evidence for global warming?

The extent of the ice cover on Mt. Kilimanjaro decreased by 81% between 1912 and 2000.

Retreat of glaciers

Evidence for global warming?
The Larsen B ice shelf disintegrates, setting thousands of ice bergs adrift in the Weddell Sea in 2002.
720 billion tons of ice!

Decrease in Arctic Sea-Ice

Observed Changes in Sea Level, Temperature and N.H. Snow Cover

The future

Change in volcanic aerosol

Source: Sato et al. GISS, NASA
Global Averages of Surface Warming
(relative to 1980-99)

Predicted Climate Changes in California:
Temperature

Projected Changes in Temperature

Arctic summer sea-ice could disappear by 2080s
under IPCC High Emissions scenario

Projected Changes in Precipitation
(for 2090-2099 relative to 1980-1999)

Solutions?
The Kyoto Protocol, an international agreement to reduce emissions of six greenhouse gases, came into effect on February 16, 2005. The protocol sets mandatory limits on greenhouse gas emissions for each of the party nations with the goal of reducing total global emissions to 5.2% below their 1990 values by 2012. 166 countries have now ratified the agreement – but not the U.S.

Helen Cox, 2007


Helen Cox, 2007
Mitigation Efforts: California AB32

California is the 12th largest emitter of carbon dioxide in the world.

On June 1st, 2005 Governor Schwarzenegger signed Executive Order S-3-05, establishing Greenhouse gas targets for the State.

On September 27, 2006 Governor Schwarzenegger signed Assembly Bill 32, California Global Warming Solutions Act of 2006, authored by Assembly Speaker Fabian Nunez (D-Los Angeles).

• AB 32 requires that the statewide greenhouse gas emissions be cut to their 1990 levels by 2020. This will require a cut in emissions from the State’s largest emitters by about 25%.
• Beginning in 2008 the California Air Resources Board will require industry to report on their GHG gas emissions.
• Reductions will be continued to 80% below 1990 levels by 2050.
• In July, 2006 an agreement was signed between California and the United Kingdom to create an international partnership to fight against global warming.
• On Jan 18, 2007, a new Low Carbon Fuel Standard was introduced for transportation fuels. This requires fuel providers to reduce the carbon content of passenger vehicle fuels sold in California by 10% by the year 2020. Transportation accounts for 40% of California’s GHG emissions, and 96% of these fuels are petroleum based.

What you can do
Support and encourage local alternative energy projects.

In 2005 CSUN installed a 1 megawatt fuel cell power plant — the single largest fuel cell power plant at any university in the world. The power plant provides environmentally friendly power to the campus, and reduces the university’s CO2 emissions by 60 million pounds during its lifetime. The plant will generate electricity for the university’s facilities and surplus heat for buildings, showers and food service hot water, and for heating the swimming pool.

In 2001, CSUN installed six microturbines through a partnership with the South Coast Air Quality District and LADWP as a way to save energy and reduce its reliance on the state’s fragile electrical grid.

What you can do
Support and encourage local alternative energy projects.

CSUN, with support of LADWP and the Gas Company has installed nearly 6,000 solar panels totaling nearly 700,000 watts of power on the campus as a way of providing power while saving energy and reducing costs.
What you can do: Personal options

- Plant trees
- Install solar panels
- Switch to energy saving appliances
- Recycle
- Drive a fuel efficient vehicle
- Use mass transit, cycle, carpool
- Buy green energy

What you can do: Personal options

- Turn off the air conditioner
- Turn off the lights when you leave a room
- Install compact fluorescent light bulbs
- Don’t fly unless you have to
- Buy locally grown produce
- Put your water heater on a timer
- Use recycled paper and timber

What you can do.

This year – GOAL: Reduce your emissions by 3 – 4%:

1. Your car.
   Avg. American drives 15,600 miles per year
   4% reduction = driving about 12 fewer miles per week
   Another 4% by getting 1 – 2 more mpg:
   - minimize high-speed driving (fuel economy drops 17% between 55 and 70 miles per hour);
   - idle for no more than 30 seconds
   - keep tires properly inflated.

What you can do.

This year – GOAL: Reduce your emissions by 3 – 4%:

2. Your lights
   Lighting accounts for 5 - 10 % of the average household’s energy budget.
   Replace incandescent bulbs with compact fluorescent lights (CFLs), which use 25% - 33% of the energy to provide the same amount of light. CFLs also last up to 10 times longer.

What you can do.

This year – GOAL: Reduce your emissions by 3 – 4%:

   Lowering your water heater’s thermostat by 10° (or to 120 °F) or your heating thermostat by 2° can both reduce your energy use 3 – 5%.
   Buy appliances or equipment with Energy Star-rated models

What you can do.

This year – GOAL: Reduce your emissions by 3 – 4%:

4. Waste less.
   Unplug a freezer. One of the quickest ways to reduce your global warming impact is to unplug the extra refrigerator or freezer you rarely use -- except when you need it for holidays and parties. This can reduce the typical family’s CO2 gas emissions nearly 10%.

5. Power choice
   Buy “green power” (electricity generated from renewable resources such as the sun and wind)
What you can do.

This year – GOAL: Reduce your emissions by 3 – 4%:

6. Microwave.
How did we ever live without them?
Great for many cooking and use 67% less energy than an electric oven. During the summer, they won’t heat up your kitchen and make you turn up the A/C.

7. Wash your clothes in cold water instead of hot.
If you use the right detergent, your clothes will be just as clean and you will cut your energy use in half.

Avg mpg of car today = 24 mpg
We have the technology to raise this to 40 mpg today.
Each gallon of gas releases 20 - 25 lbs CO₂

Cost of Renewable Energy Sources

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>1998</th>
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Source: US Department of Energy, 1997

What you can do: Websites

If you visit only one site, visit this one from the Union of Concerned Scientists:
http://www.ucsusa.org/

Facts and figures from the EPA:
http://www.epa.gov/climatechange/

What you can do (Inconvenient Truth):
http://www.climatecrisis.net/

The scientific facts from the IPCC (Intergovernmental Panel on Climate Change):
http://www.ipcc.ch/