NIE

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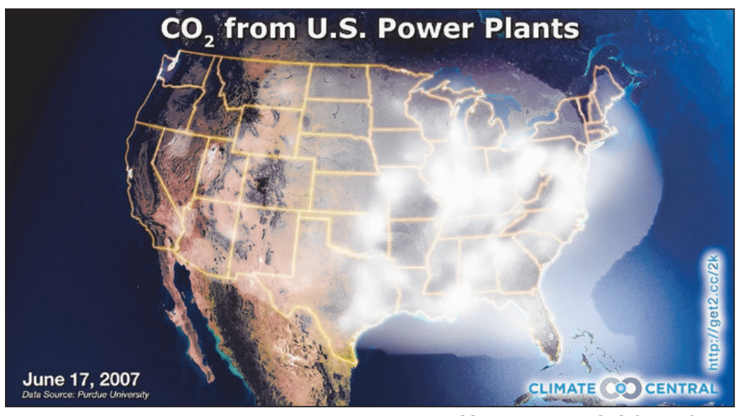

CONTRIBUTED PHOTO/Climate Central

Find out where, when levels of CO2 increase

By ANNA MCCARTNEY
Contributing writer

Although carbon dioxide is invisible, the Vulcan Project, directed by Dr. Kevin Gurney at Purdue University, has created a tool to help visualize it.

In the image above, shades of white mark the density of CO2 emitted from electric power in the U.S. on June 17, 2007. The animated version of the graphic covers a week's worth of emissions; they cycle up and down as electricity demand rises during the day and drops at night.

The image clearly shows more CO2 emissions from power plants in the central and eastern US, where much more coal is burned than in the western U.S. More than 80 percent of CO2 emissions associated with electric power generation in the U.S. are due to coal burning.

The Vulcan Project uses geo-referenced, hourly CO2 emissions from all major emitting sources to model the nationwide pattern. The CO2's dispersion into the atmosphere is simulated using a meteorology model developed at Colorado State University (RAMS, the Regional Atmospheric Modeling System).

From 1000 A.D. to about 1750 AD, carbon dioxide levels in the atmosphere hovered between 275 and 285 parts per million (ppm), and then began to increase. Initially, the increase was largely due to the burning of coal, which was the primary energy source for the Industrial Revolution. Since then, oil and natural gas, the other major fossil fuels, have also become sources of growing CO2 levels.

Fossil fuel burning remains the predominant source of the historical increase in atmospheric CO2 concentrations which added about 100 ppm (36 percent) over the last 250 years to the CO2 levels of the preindustrial era.

But other factors contribute as well. For example, the widespread deforestation in some areas adds CO2 to the atmosphere if the trees are burned. Like fossil fuels, they release this greenhouse gas. Trees left to rot also release CO2, albeit more slowly. And because living trees absorb CO2 in the process of photosynthesis, the cutting of forests eliminates a source of CO2 removal, so the gas builds up more quickly than it might otherwise.

Some manufacturing processes also add CO2 to the atmosphere. Cement manufacturing is one; it not only requires energy, which often comes from fossil-fuels, but the chemical reactions involved in its manufacture release this greenhouse gas to the atmosphere.

ANNA MCCARTNEY, *a communications and education specialist for Pennsylvania Sea Grant, can be reached by e-mail at axm40@psu.edu.*

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What: Presque Isle After Dark: Take a winter night hike on a full moon night. For ages 10 and older.
Where: Meet at the Pine Tree Pavilion parking lot, beach 9
When: Jan. 19 at 6 p.m. to 7:30 p.m.
Cost: No fees or registration
For more information, contact: Ray Bierbower at 833-0793

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CONTRIBUTED PHOTO

JoAnna Connell students win trivia competition about sustainable energy.

Student teams compete on energy knowledge

By ANNA MCCARTNEY
Contributing writer

Can solar panels provide energy for your home even in cloudy Erie? Students that attended the Earth Action Sustainable Energy Youth Training Day held recently at the Tom Ridge Environmental Center now know that they certainly can.

They also know answers for many other questions about energy; this information can lead to better choices than fossil fuels, which are finite and add too much CO2 to the earth's natural carbon cycle upsetting the balance. Students also learned about other renewable energy sources like wind, geothermal and biofuels.

Each school that attended the event made up five trivia questions on information they had learned that day and then were divided into two groups of schools with six teams competing in each division to answer the questions.

JoAnna Connell Elementary School students were the victors in their division.

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CONTRIBUTED PHOTO/NOAA

NOAA engineer Paul Fukumura-Sawada captures air near NOAA's Mauna Loa Observatory in Hawaii, using one of the many methods to measure carbon dioxide and other greenhouse gases in earth's atmosphere. Scientists have continuously monitored and collected data related to climate change since the 1950s at this site when Keeling began his measurements.

Ahead of the Curve

Scientist's work links fossil fuels, carbon emissions

By ANNA MCCARTNEY
Contributing writer

An impeccable half-century record that measures the steep rise of carbon dioxide in our atmosphere stands unchallenged.

In 1958, a young researcher named Charles David Keeling started measuring CO2 to answer the question many scientists had been asking: Did the increasing use of fossil fuels cause a rise in atmospheric CO2? Scientists knew that CO2 was produced whenever humans burned wood, coal, oil and gas. What was not clear was what happened to all the extra CO2 produced by a carbon source that had been buried for millions of years.

Since no instruments were available to accurately measure this colorless gas, Keeling designed them and developed the techniques that allowed him to achieve great precision in his measurements. Until his death in 2005, Keeling spent his life working for the Scripps Institution of Oceanography, measuring steadily increasing levels of worldwide CO2 and learning about its effect on our climate and ocean systems.

The daily measurements begun by Keeling at a weather station atop Hawaii's Mauna Loa became known as the Keeling Curve. Among his most insightful discoveries and one of the many indicators of the Keeling Curve's sensitivity and accuracy was the data that showed CO2 levels drop slightly during the northern hemisphere spring and summer and go back up in the fall and winter.

Keeling explained this detailed seasonal "breathing" of the planet. Plants take up CO2 as they sprout leaves and grow over the summer, but as the plants shed their leaves and grow dormant in the winter they give off CO2.

Research is painstaking

His work ranks very high among the achievements of 20th-century science because it transformed scientific understanding of humanity's relationship with the earth. Keeling is unforgettable because his painstaking years of research and innovation show that the peak level of CO2 grew higher each year since he began taking measurements, and that it was rising quickly. Chemical tests conducted by Keeling and others proved the increase was caused by human combustion of fossil fuels.

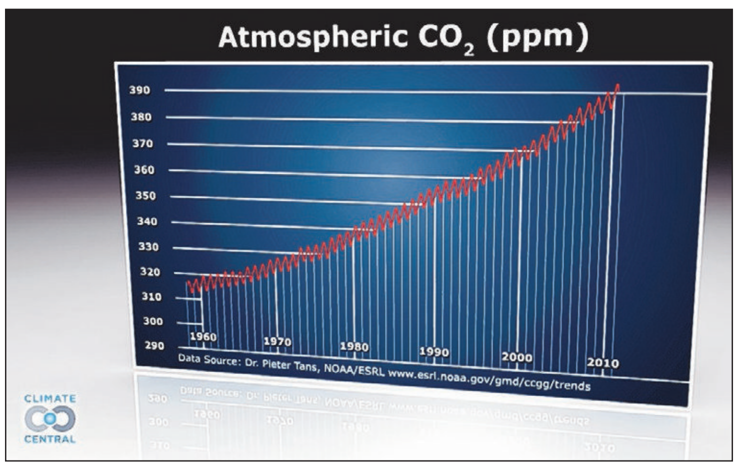
While many people have never heard of Keeling or his son, Ralph, who has taken over his father's research, the trend of rising carbon dioxide is undeniable. Climatologists around the world use his trustworthy measurements to explain the carbon cycle and the dangerous changes caused by too much CO2.

Isolated in the middle of the Pacific Ocean at more than 11,000 feet above sea level, the site is an ideal location to measure atmospheric CO2. Keeling positioned the CO2 sensors at Mauna Loa to sample incoming breezes directly from the ocean, unaffected by human activities, vegetation or other factors on the island. There are no local influences such as factories or forests that might boost or drop carbon dioxide within this vicinity.

While volcanoes are considerable sources of carbon dioxide, the sampling location was chosen to be normally upwind of Mauna Loa's vent. Keeling also perfected methods to detect and correct for intervals when the wind blew the wrong way.

Trends confirmed

Measurements at about 100 other worldwide monitoring sites confirm the long-term trend shown by the Keeling Curve, but none have a record as long as Mauna Loa. Without Keeling's longer record, awareness of global change would have come more slowly. And sudden events, such as the marked fluctuations in global CO2 uptake after the 1991 volcanic eruption of Mount Pinatubo, may have looked very different in the context of a 15-year rather than a 50-year record.



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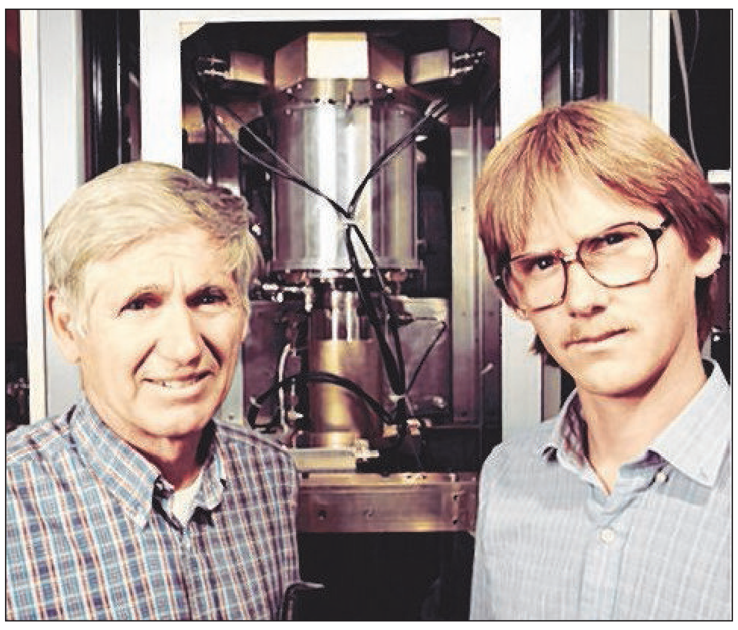
The "Keeling Curve," a record of carbon dioxide concentrations started by the Charles Keeling in 1958, is probably one of the greatest scientific discoveries of the 20th century. It provided the first clear evidence that CO2 was accumulating in the atmosphere as the result of mankind's use of fossil fuels. The small annual zigzag visible on the curve is timed with the seasons.



CONTRIBUTED PHOTO

Charles Keeling with his son Ralph in 1989. Many committed scientists like the Keelings are unsung and underfinanced, but their work brings us important discoveries about how the world is changing under the increasingly global influence of humans.

By the 1970s, the relationship between rising CO2 levels and fossil-fuel burning was firmly established. Simple and unambiguous, Keeling's work changed our view of the world. And once he had established the importance of CO2 measurements, the government began making its own, in the early 1970s. Today, both National Oceanic and Atmospheric Administration and Scripps operate a monitoring program at Mauna Loa and other sites. Each of these records of measurements serves as a quality check on the other.

Researchers have been able to put the Keeling measurements into a broader context. Bubbles of ancient air trapped by glaciers and ice sheets have been tested, and they show that over the past 800,000 years, the amount of carbon dioxide in the air fluctuates between roughly 200 and 300 parts per million. Just before the Industrial Revolution, the level was about 280 parts per million and had been there for several thousand years.

Heed scientists' research

Keeling's earliest measurements of the air in the mid-1950s show the background level for carbon dioxide by then was about 310 parts per million. Today the levels have grown to 390 parts per million. The Keeling Curve provides indirect evidence that a little less than half of the human-produced carbon dioxide emissions remain in the sky and about a third enters the oceans, dissolving into seawater at the ocean surface.

In 1996, Keeling and his Scripps' colleagues showed that the amplitude of the Northern Hemisphere atmospheric CO2 seasonal cycles has been increasing, providing independent support for the conclusion that the growing season is beginning earlier, perhaps in response to global warming.

This unlikely hero and thousands of scientists around the world at Scripps, NOAA and other organizations have been working tirelessly for little pay or recognition to do the research and sound the alarms that the rest of the population needs to understand and take seriously. Unless we listen to these scientists and their warnings, we will remain ill equipped to combat the problems caused by an ever-growing population that remains dependent on fossil fuels.

ANNA MCCARTNEY, *a communications and education specialist for Pennsylvania Sea Grant, can be reached by e-mail at axm40@psu.edu.*

Check out these websites to learn more:

www.esrl.noaa.gov/
www.scrippsco2.ucsd.edu/
www.climate.gov/#education
www.seagrant.psu.edu/extension/climatechange.htm
www.sos.noaa.gov/datasets/

Long-term data is invaluable in studying and understanding how organisms will respond to present-day abrupt climate change. Studies that have recorded data over the last several decades, and in some cases centuries, allow scientists to make comparisons with data collected today.

Newspapers share lots of data every day of the year. Find examples of information that can be useful for comparing future events to those that happened today.

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