

# HEAT

Greenhouse heat/day **Unit 20** Dr. John P. Cise, Professor of Physics, Austin Com. College, 1212

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BY DEGREES

## What to Make of a Warming Plateau



A storm gathered over Bangkok. Despite a recent lull, climate scientists say it is an open question whether the pace of warming has undergone any lasting shift.

As unlikely as this may sound, we have lucked out in recent years when it comes to [global warming](#). **The rise in the surface temperature of earth has been markedly (slower over the last 15 years than in the 20 years before that.)** **And that lull in warming has occurred even as greenhouse gases have accumulated in the atmosphere at a record pace.** The slowdown is a bit of a mystery to climate scientists. True, the basic theory that predicts a warming of the planet in response to human emissions does not suggest that warming should be smooth and continuous. To the contrary, in a climate system still dominated by natural variability, **there is every reason to think the warming will proceed in fits and starts.** But given how much is riding on the scientific forecast, the practitioners of climate science would like to understand exactly what is going on. They admit that they do not, even though some potential mechanisms of the slowdown have been suggested. The situation highlights important gaps in our knowledge of the climate system, some of which cannot be closed until we get better measurements from high in space and from deep in the ocean. We certainly cannot conclude, as some people want to, that carbon dioxide is not actually a greenhouse gas. More than a century of research thoroughly disproves that claim. In fact, **scientists can calculate how much extra heat should be accumulating from the human-caused increases in greenhouse gases, and the energies involved are staggering. By a conservative estimate, current concentrations are trapping an extra amount of energy equivalent to 400,000 Hiroshima bombs exploding across the face of the earth every day.** So the real question is where all that heat is going, if not to warm the surface. And a prime suspect is the deep ocean. Our measurements there are not good enough to confirm it absolutely, but a growing body of research suggests this may be an important part of the answer.

MIT news on Temp Cg.

The new projections, published this month in the American Meteorological Society's Journal of Climate, indicate a median probability of surface warming of 5.2 degrees Celsius **by 2100, with a 90% probability range of 3.5 to 7.4 degrees.** This can be compared to a median projected increase in the 2003 study of just 2.4 degrees.

**INTRODUCTION:** One Hiroshima like bomb produces  $67 \times 10^{12}$  joules(J) energy. That's equivalent to about 15 kilotons of TNT. Here ,it is said ,the greenhouse gas effect traps an energy amount equivalent to 400,000 Hiroshima like bombs/day.

**QUESTIONS:** (a) How many Joules of energy are Trapped by the greenhouse effect per day?  
(b) How many Joules of energy are trapped by the greenhouse effect per year?

**HINTS:** 365 days/year

**ANSWERS:** (a)  $2.68 \times 10^{19}$  Joules/day  
(b)  $9.78 \times 10^{21}$  Joules/year