Energy and Environment –
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with Eric Lindahl, Bob Koon of the UW Geophysical Fluid Dynamics Laboratory
the sun’s ultraviolet (left) and infrared radiation

[imagers.gsfc.nasa.gov/ems/uv.html](http://imagers.gsfc.nasa.gov/ems/uv.html)
[www.odysseymagazine.com/images](http://www.odysseymagazine.com/images)
Energy can be ‘concentrated’ or ‘dilute’ that is, intense or weak. Concentration of energy can occur chemically or physically. Here a mirror curved in the shape of a parabola will focus the sun’s rays on a point.
and set a 2 x 4 " wood plank on fire, if it is placed near the focal point.
The Greenhouse effect

Solar radiation passes through the clear atmosphere.
- Incoming solar radiation: 343 Watt per m²
- Net incoming solar radiation: 244 Watt per m²

Some solar radiation is reflected by the atmosphere and earth’s surface
- Net outgoing infrared radiation: 244 Watt per m²

Some of the infrared radiation is absorbed and re-emitted by the greenhouse gas molecules. The direct effect is the warming of the earth’s surface and the troposphere
- Outgoing solar radiation: 103 Watt per m²

Surface gains more heat and infrared radiation is emitted again
- Solar energy is absorbed by the earth’s surface and warms it: 168 Watt per m²

... and is converted into heat causing the emission of longwave (infrared) radiation back to the atmosphere

Sources: Caricature university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group I to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.
water vapor moving in the atmospheric circulation...red=high content, blue=low
evaporation from the tropical and mid-latitude oceans is the source, with precipitation both in tropics and at high latitude being the balancing 'sink'
American Golden Plover
green plants on the surface of the ocean and land, inferred from color viewed by the SeaWiFS satellite (interpreted as chlorophyll concentration in the sea)
plot of atmospheric carbon dioxide concentration (vertical axis) against time (1994-2003 left-right axis) and Earth’s latitude: this is the annual ‘breathing’ of the biosphere, which is most intense in the Northern Hemisphere. The colors also show the amplitude, which is currently rising at a rate of about 2.5% per year…significantly faster than in the 1990s.
Energy

forms of energy
  concentrated, diluted

conservation

transmission/movement
transformation
  efficiency of transformation
  heat engines
degradation (and entropy)
storage
‘utilization’ by plants and animals
carbon cycle, photosynthesis

Global Environment

physical, chemical, biological
atmosphere, ocean, land surface
energy, air, water, ice, carbon

the sun-atmosphere-ocean heat engine

fluid circulations in which protective
‘niches’ of life develop

Arctic populations

natives: settlement
Europeans: exploration
assimilation, exploitation

shaping of their lives
by energy and food
resources in a harsh
environment

amplified global
warming in the Arctic

Humans and energy

history of energy demand
and development
  ....fossil fuels

connections with evolution

alternative energies
Grand ideas, great problems....solutions?

physics and chemistry of the environment:

evolution at many scales
molecular biology’s imprint
coevolution of physical world and biology....Gaia

global climate change: driven
both by human activity and natural cycles of variability

human population: 6.77 billion and counting
its multi-pronged impact

integrity of the global biosphere, with humans
joining the ranks yet not in charge
Grand ideas, great problems....solutions?

physics and chemistry of the environment:

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integrity of the global biosphere, with humans joining the ranks yet not in charge
After a small increase in 2003, global cigarette production declined 2.3 percent in 2004 to 5.5 trillion units. Per-capita production worldwide has not been this low since 1972. China, the United States, Russia, and Japan, the four largest producers, manufacture just over half of the world's supply. In 2004, China produced 1.79 trillion cigarettes, 32 percent of the global total. Unlike China, whose people smoked 99 percent of the cigarettes produced domestically, the United States exported 24 percent of its total production of 499 billion.

http://www.worldwatch.org/node/131
our texts
big numbers

….. riding on top of a rapidly changing ‘mean’
more numbers: measures of the state of the physical, biological global environment

humans in the global environment
case study: Arctic natives living for ~ 6000 years in the harshest of environments
global problems

‘commodification’ of natural resources by the investment speculators

..... and solutions

‘systemic’.... analyzing the whole footprint of a factory or market

...technological
deep philosophy of the environment..... reaching even to speculative finance and securitized mortgages.

The End of Nature
BILL MCKIBBEN

THE AGES OF GAIA
A Biography of Our Living Earth
James Lovelock

MARGARET ATWOOD
PAYBACK
(Debt and the Shadow Side of Wealth)