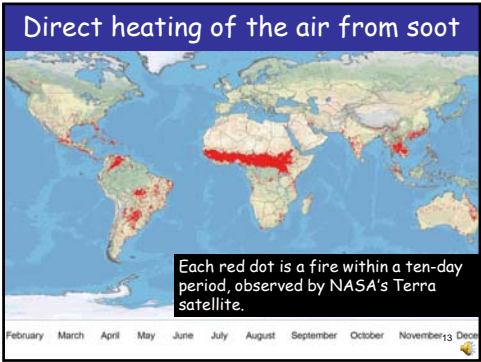
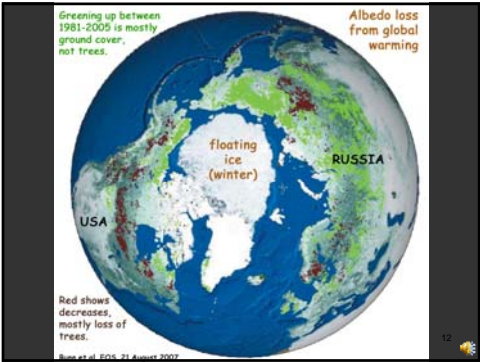
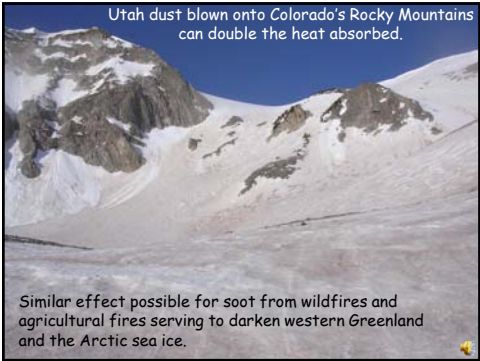
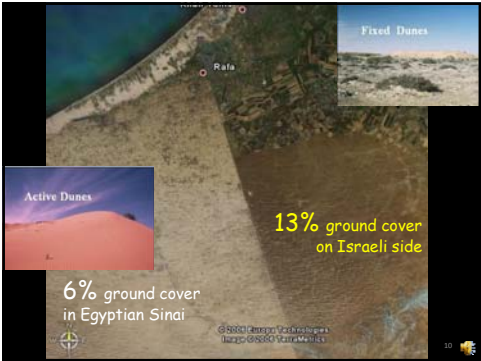
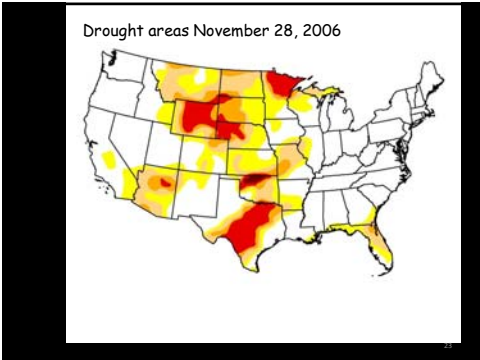
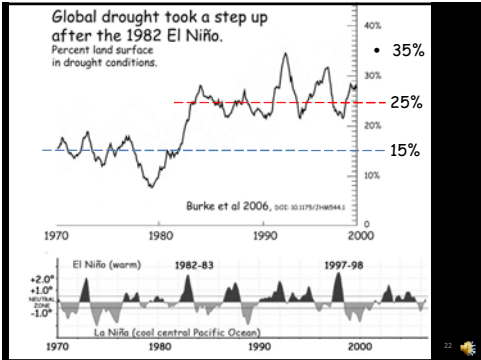
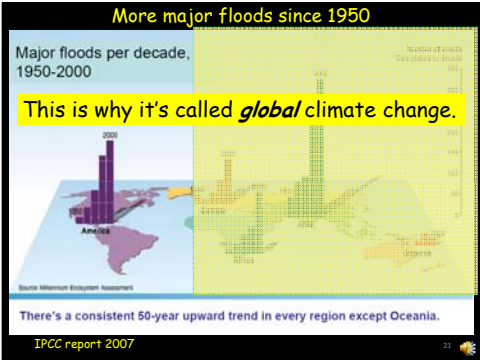
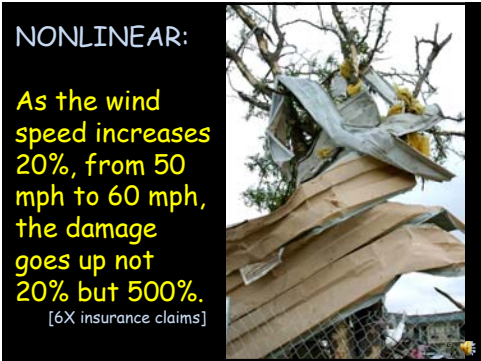
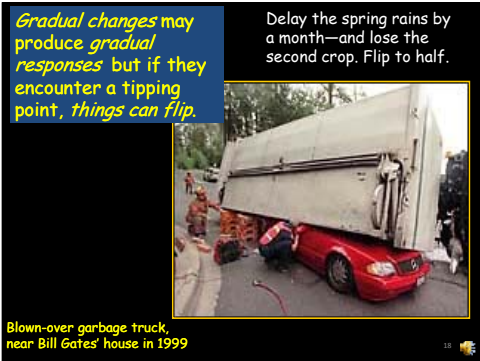
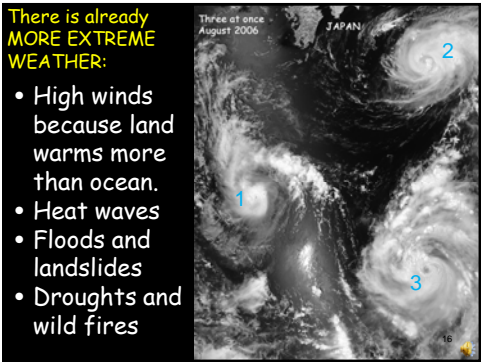
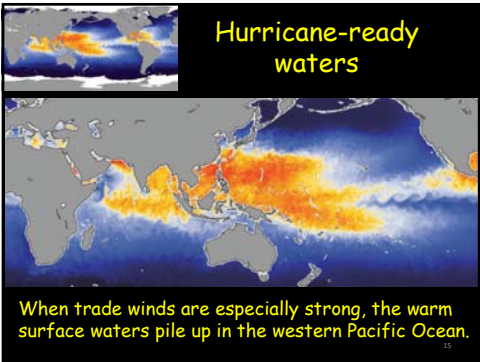
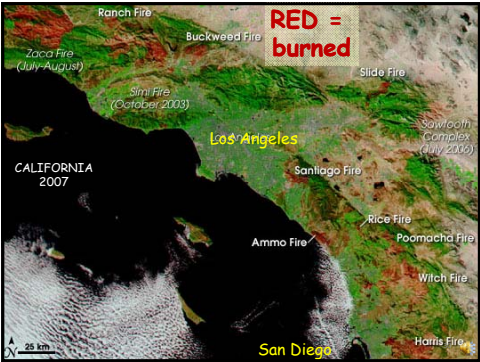
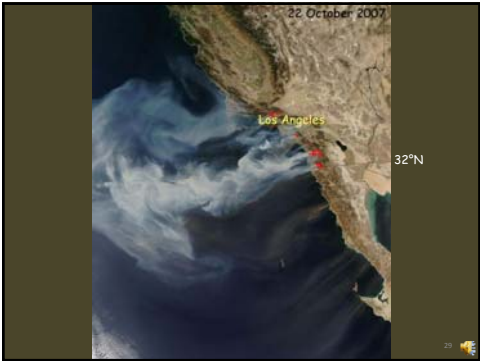
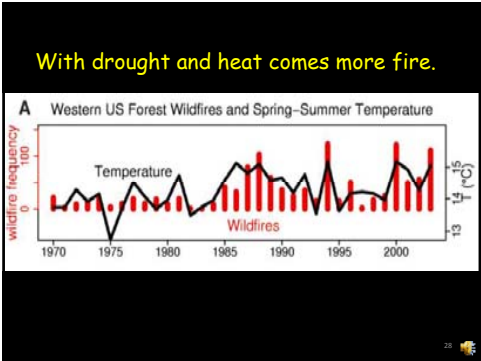
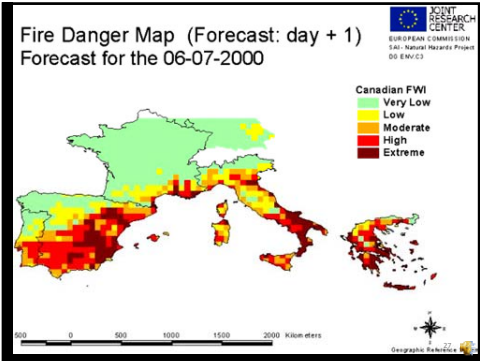
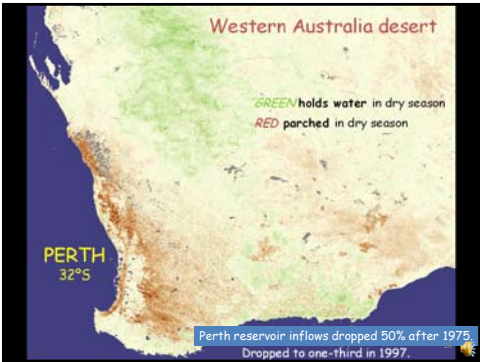
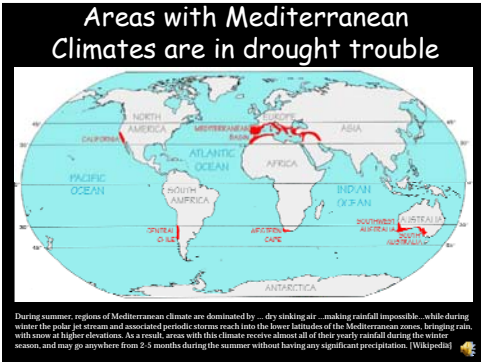
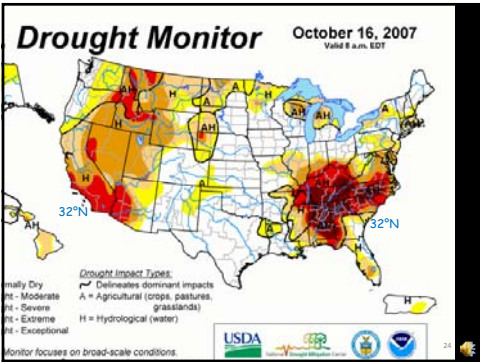


- The Great Use-it-or-lose-it Intelligence Test
1. How Bright the Earth
 2. 50 years of climate change already
 3. Getting into Hot Water
 4. Sea Level Rise
 5. CO₂, CH₄ rise, CO₂e
 6. Fossil Fuel CO₂e pie chart
 7. Taking CO₂ out of circulation
 8. The Tortoise & the Hare
 9. The Need (and Ability) to "Turn on a Dime."



- The Great Use-it-or-lose-it Intelligence Test
1. How Bright the Earth
 2. 50 years of climate change already
 3. Getting into Hot Water
 4. Sea Level Rise
 5. CO₂, CH₄ rise, CO₂e
 6. Fossil Fuel CO₂e pie chart
 7. Taking CO₂ out of circulation
 8. The Tortoise & the Hare
 9. The Need (and Ability) to "Turn on a dime."





- The Great Use-it-or-lose-it Intelligence Test
1. How Bright the Earth

2. 50 years of climate change already

3. Getting into Hot Water

4. Sea Level Rise

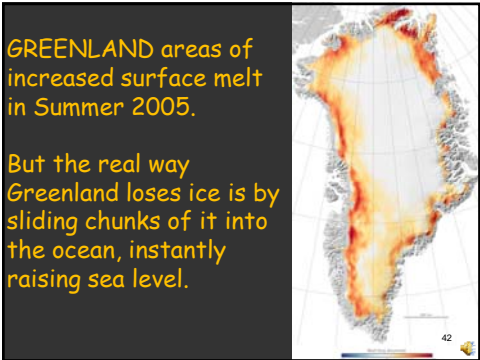
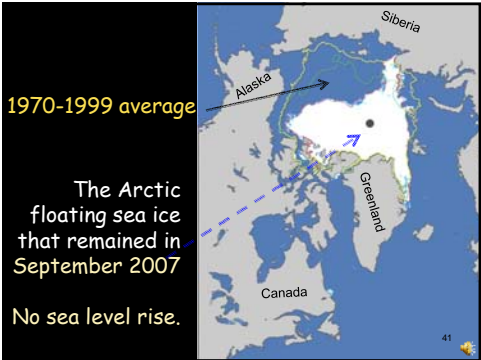
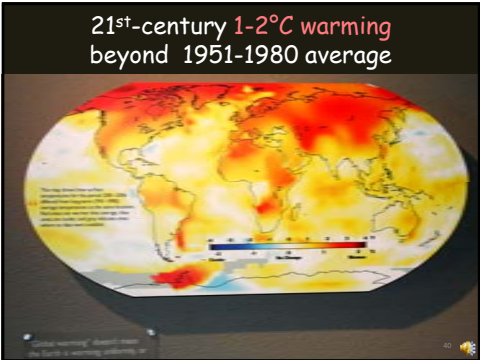
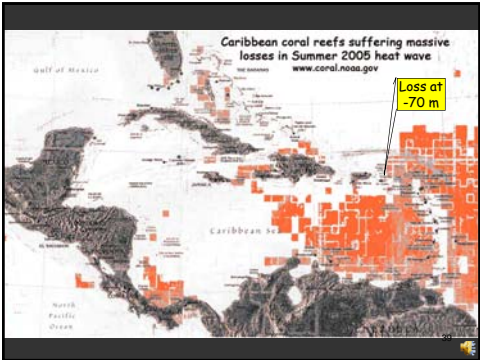
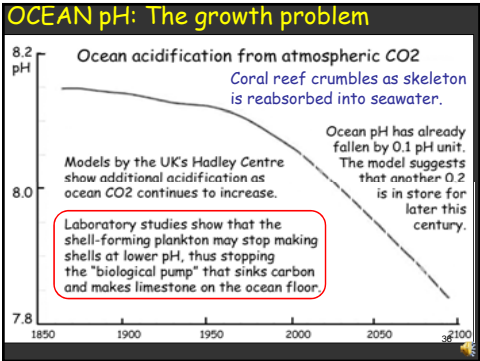
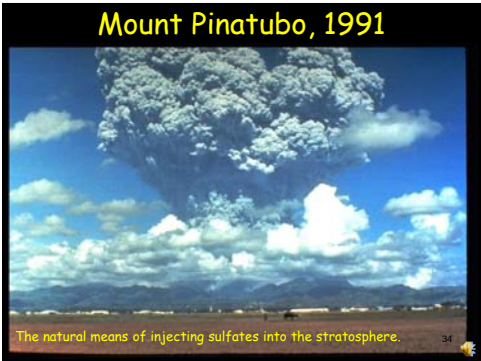
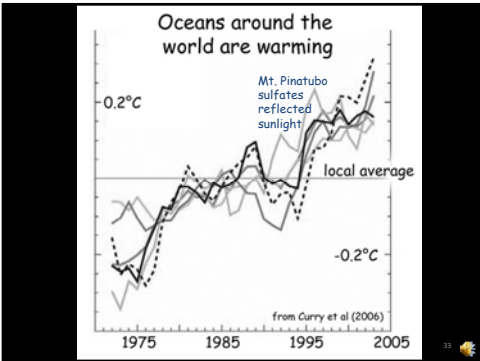
5. CO₂, CH₄ rise, CO₂e

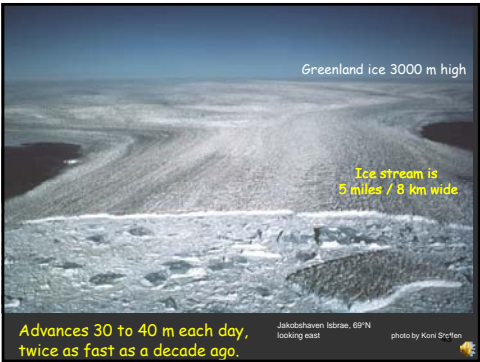
6. Fossil Fuel CO₂e pie chart

7. Taking CO₂ out of circulation

8. The Tortoise & the Hare

9. The Need (and Ability) to "Turn on a dime."





The Great Use-it-or-lose-it Intelligence Test

1. How Bright the Earth

2. 50 years of climate change already

3. Getting into Hot Water

4. Sea Level Rise

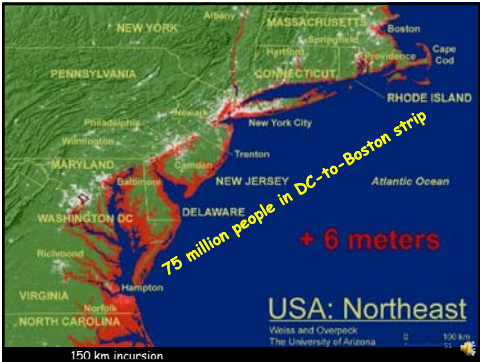
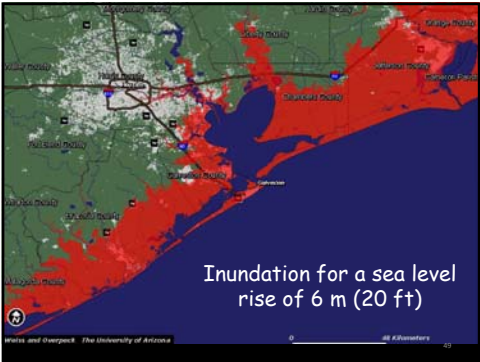
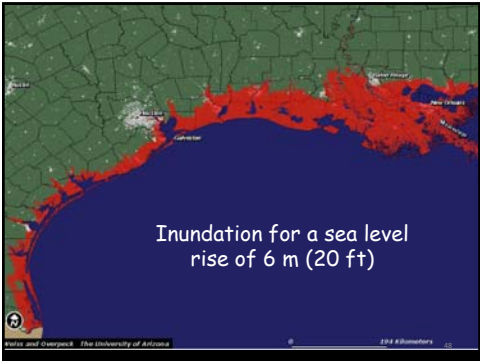
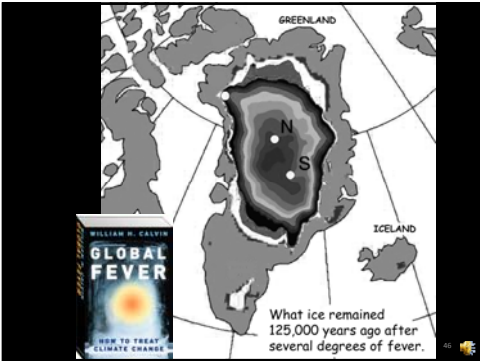
5. CO₂, CH₄ rise, CO₂e

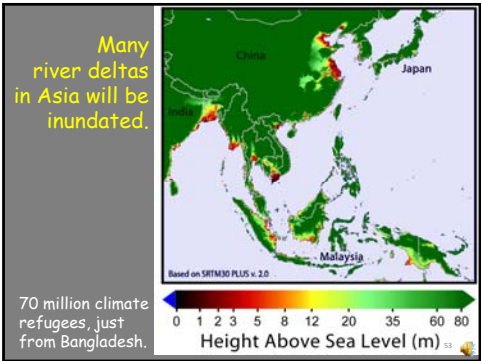
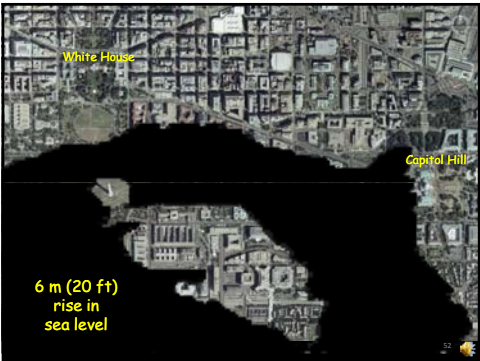
6. Fossil Fuel CO₂e pie chart

7. Taking CO₂ out of circulation

8. The Tortoise & the Hare

9. The Need (and Ability) to "Turn on a dime."





The Great Use-it-or-lose-it Intelligence Test

1. How Bright the Earth

2. 50 years of climate change already

3. Getting into Hot Water

4. Sea Level Rise

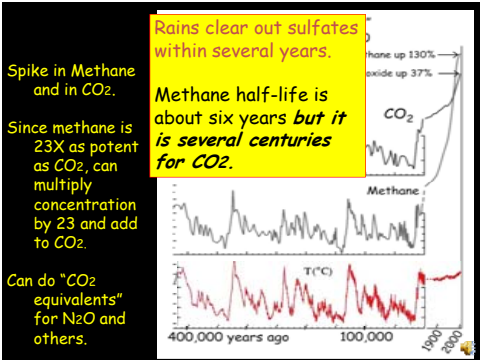
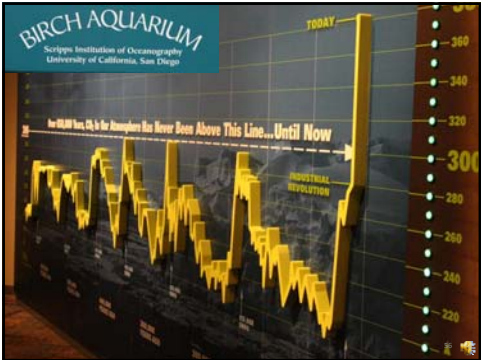
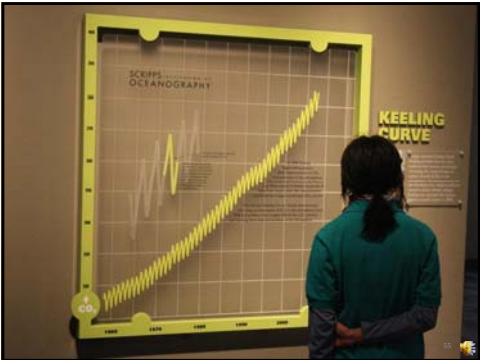
5. CO₂, CH₄ rise, CO₂ equivalents

6. Fossil Fuel CO₂e pie chart

7. Taking CO₂ out of circulation

8. The Tortoise & the Hare

9. The Need (and Ability) to "Turn on a dime."



The Great Use-it-or-lose-it Intelligence Test

1. How Bright the Earth

2. 50 years of climate change already

3. Getting into Hot Water

4. Sea Level Rise

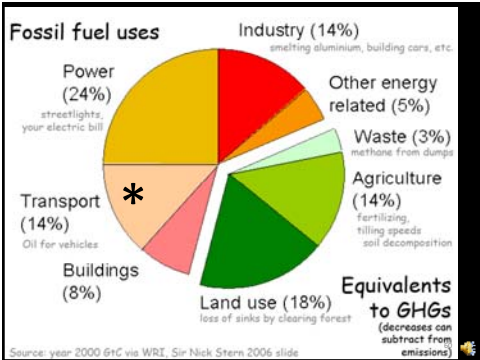
5. CO₂, CH₄ rise, CO₂ equivalents

6. Fossil Fuel CO₂e pie, replacements

7. Taking CO₂ out of circulation

8. The Tortoise & the Hare

9. The Need (and Ability) to "Turn on a dime."





wheels

Back to front page

WEDNESDAY, 21 SEP 2006 1:41 AM

L.A. Auto Show: Driving Honda's Fuel-Cell FCX

By MICHAEL GOODMAN

TAGS: AUTO SHOW, FUEL CELL, HONDA FCX, HYDROGEN, LOS ANGELES

The Honda FCX Clarity, powered by a hydrogen fuel cell, will be tested by retail customers next year.

LOS ANGELES — Before heading off to LAX for my flight home from the auto show last Sunday, I spent a morning driving what may be the most advanced road vehicle on the planet: the Honda FCX Clarity. This fuel-cell-powered car, unveiled in production-ready form at the convention center earlier in the week, will be built in small numbers and leased next summer to retail customers for their everyday use.

Converting Commuters

1. Plug-in hybrids and all-electric vehicles
2. Hydrogen produced by clean electricity
3. Compressed air vehicles, again using clean electricity to produce an intermediate mobile fuel.



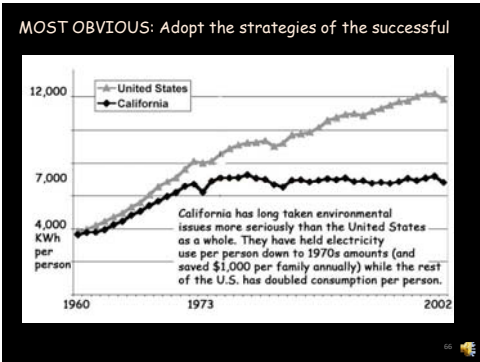
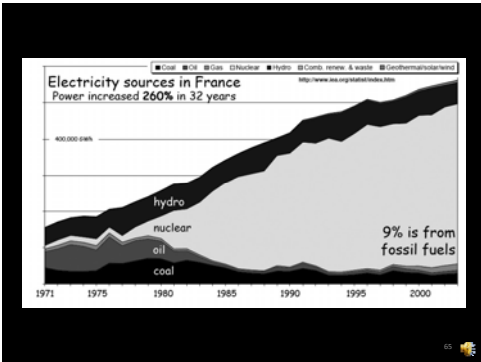
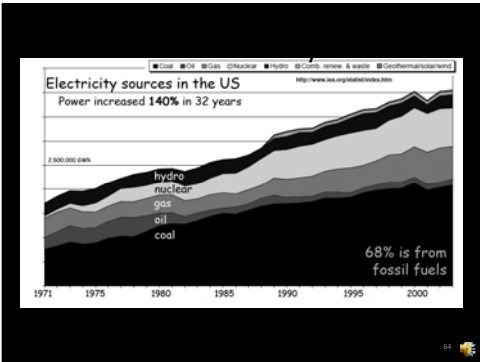
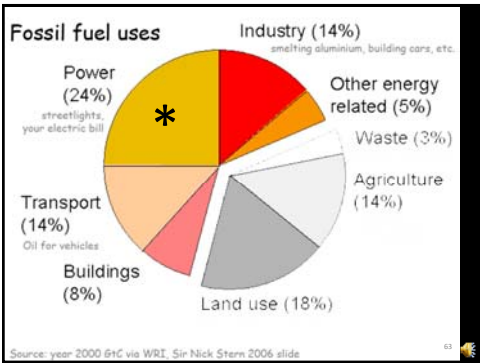
Air car

(with free air cooling)

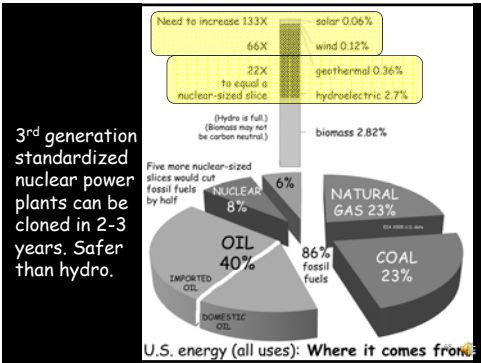
India's largest automaker is set to start producing the world's first commercial air-powered vehicle. "Some 6,000 zero-emissions Air Cars are scheduled to hit Indian streets in August of 2008. This six-seat taxi is powered entirely by a tank filled with **compressed air**."

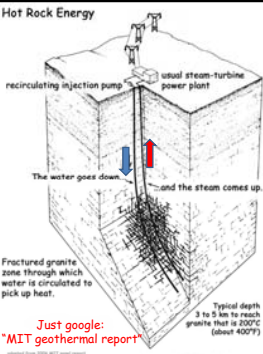


Air engine... 2007... run backward to recompress air over engine... Supplier: Mech...



- **Need several gigawatts of new clean power every week (and that's just for new demand in China alone, much more for replacement).**
– Even more as substitute electricity for gasoline
- **Solar and wind are, alas, not on that scale, and unstable electrical grids mean that they need storage to smooth out the current they provide.**





Hot Rock Energy

recirculating injection pump
usual steam-turbine power plant

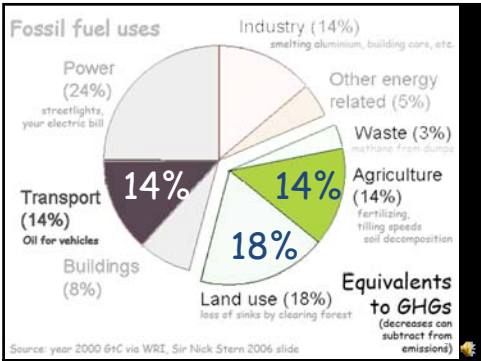
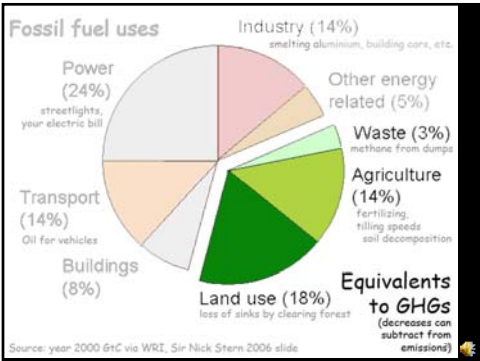
The water goes down... and the steam comes up

Fractured granite zone through which water is circulated to pick up heat

Typical depth 3 to 5 km to reach granite that is 200°C (about 400°F)

Just google: "MIT geothermal report"

- **Deep geothermal ("heat mining") pumps down water, gets steam back up to run steam turbine.**
- **No pollution, small footprint, steady output.**
- **Also suitable for developing countries.**



So while burning fossil fuels is two-thirds of the problem, much of the rest is associated with agriculture.

Certainly, many of the opportunities to fix our global climate lie in the agricultural sector because there is so much "low-hanging fruit" there, irrigation, plowing, and fertilizer practices being what they currently are.

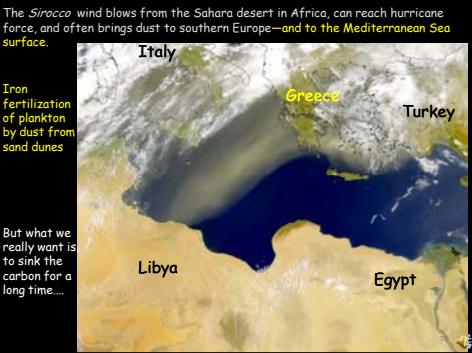
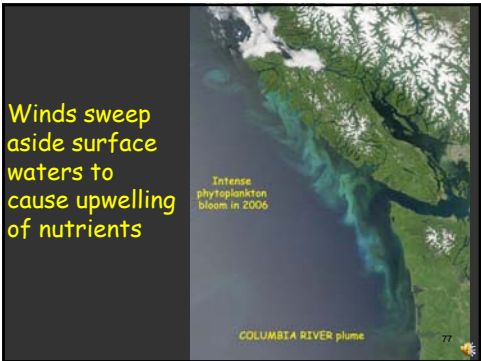
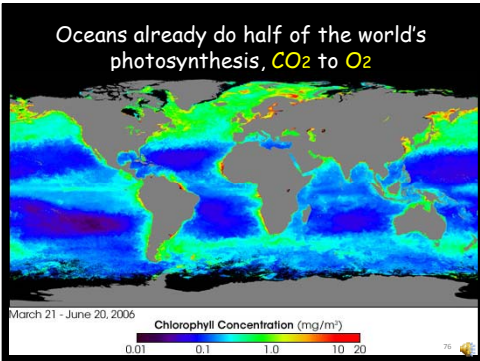
The Great Use-it-or-lose-it Intelligence Test

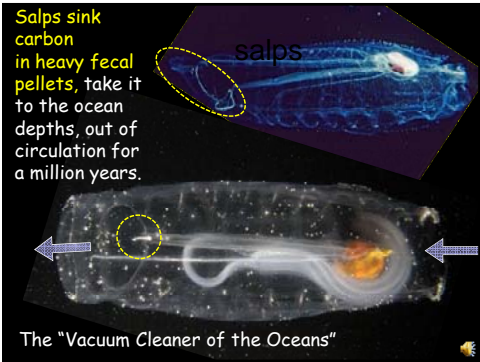
1. How Bright the Earth
2. 50 years of climate change already
3. Getting into Hot Water
4. Sea Level Rise
5. CO₂, CH₄ rise, CO₂e
6. Fossil Fuel CO₂e pie chart
7. Taking CO₂ out of circulation
8. The Tortoise & the Hare
9. The Need (and Ability) to "Turn on a dime."

REDUCING EMISSIONS IS NOT ENOUGH:
Must take excess carbon out of circulation

1. Plant many more trees
2. Manage the ocean to sink more CO₂
3. Wave-driven pump to carry surface waters down to depths.
4. Artificial photosynthesis
5. Burn biomass, capture and store CO₂

Could get more carbon sinks from more forest...
but when the climate forecast is for hot, dry, and windy...
it is too easy for fire to quickly put your sequestered carbon back into circulation.
So not reliable.





The Great Use-it-or-lose-it Intelligence Test

1. How Bright the Earth
2. 50 years of climate change already
3. Getting into Hot Water
4. Sea Level Rise
5. CO_2 , CH_4 rise, CO_2e
6. Fossil Fuel CO_2e pie chart
7. Taking CO_2 out of circulation
8. The Tortoise & the Hare
9. The Need (and Ability) to "Turn on a dime."

The Tortoise and the Hare is a fable attributed to Aesop. The story concerns a hare who one day ridiculed a slow-moving tortoise. In response, the tortoise challenged him to a race.

The hare soon left the tortoise far behind and decided to take a nap midway through the course. The tortoise, crawling slowly but steadily, won the race.

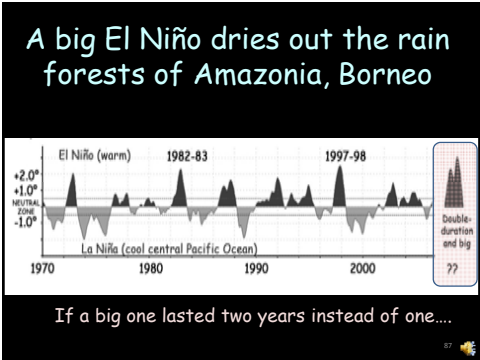
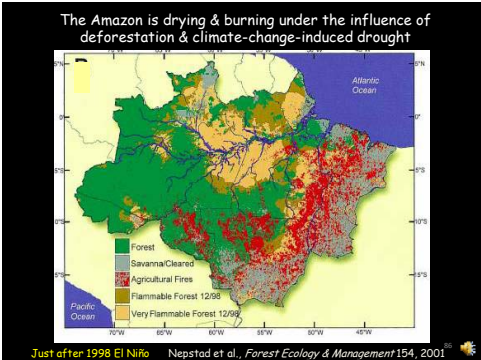
The people who study the abrupt climate shifts of the past have an aphorism:

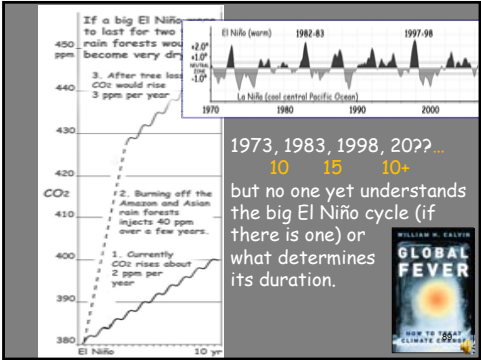
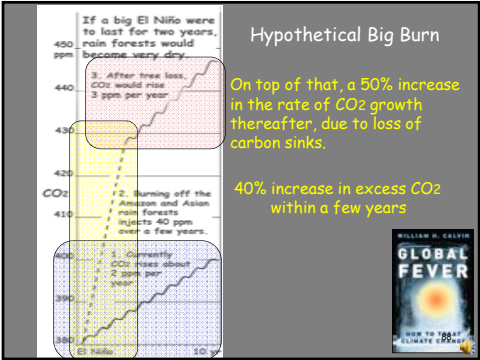
Climate is like a drunk:

Left alone, it sits.

Forced to move, it staggers.

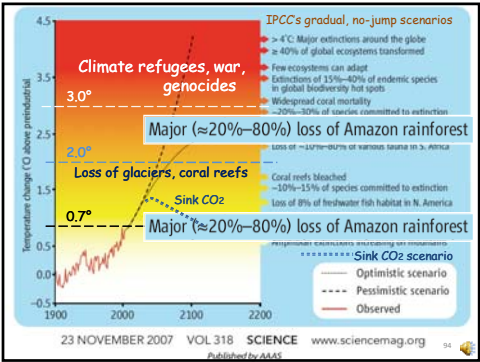
- The IPCC reports treat climate as if it moved in a stately manner like a tortoise.
- They all assume that the Hare takes a nap.
- *That is not a safe assumption.*





- The Great Use-it-or-lose-it Intelligence Test

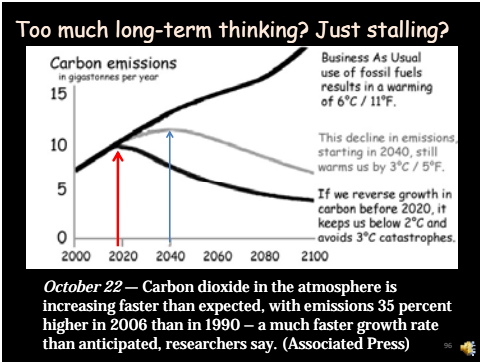
 1. How Bright the Earth
 2. 50 years of climate change already
 3. Getting into Hot Water
 4. Sea Level Rise
 5. CO₂, CH₄ rise, CO₂e
 6. Fossil Fuel CO₂e pie chart
 7. Taking CO₂ out of circulation
 8. The Tortoise & the Hare
 9. The Need (and Ability) to "Turn on a dime."



The Window of Opportunity is Rapidly Closing

At a time when architects are thinking ahead to more efficient buildings and power planners are extolling the virtues of "renewable energy," the climate modelers have discovered that long-term planning will no longer suffice.

Our fossil fuel fiasco has already painted us into a corner such that, if we don't make substantial near-term gains in ten years, the long-term is pre-empted.



Some good reasons for optimism

1. Can do the near-term with existing technologies (if we act quickly).

2. Good longer-term power solutions are already designed and the 3rd Industrial Revolution should provide more.

3. We can indeed "Turn on a dime" when we need to.



Three existing technologies, in combination, could solve the near-term part of the problem.

1. Plug-in hybrid vehicles so daily commute is mostly from the electrical grid. **Start retiring supertankers.**

2. Start building enough nuclear & geothermal power plants to **retire old coal plants.**

3. **Subsidize** countries apt to modernize, using their own coal or oil, by drilling deep geothermal wells for them.

DO THIS WORLDWIDE, and emissions *growth* will stop by 2020, limiting overheating to 2°C

President Franklin D. Roosevelt used the metaphor of a "four alarm fire up the street" that needed to be extinguished immediately, whatever the cost.

From a standing start in late 1941, the automakers converted—in a matter of months, not years—more than 1,000 automobile plants across thirty-one states . . . In one year, General Motors developed, tooled, and completely built from scratch 1,000 Avenger and 1,000 Wildcat aircraft . . . GM's duck ` was designed, tested, built, and off the line in ninety days' . . . Ford turned out one B-24 [bomber] every 63 minutes.

—Jack Doyle, *Taken for a Ride*, 2000

Now there's a source of optimism: we did it before.


The Great Use-it-or-lose-it Intelligence Test

The public interest requires doing today those things that men of intelligence and goodwill would wish, five or ten years hence, had been done.

- Edmund Burke

The End

My books and talks may be found at:
WilliamCalvin.org



Edvard Munch, *The Scream*