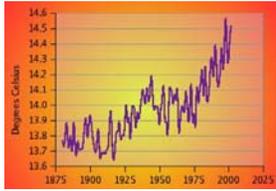


### True believers?



Intergovernmental Panel on Climate Change (2001)  
Pentagon (October 2003)  
Bush administration (August 2004)  
Conference Board (September 2004)  
U.S. Senate (June 2005)

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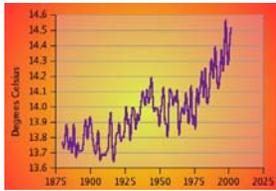
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### True believers?



“There’s a better scientific consensus on this than on any issue I know—except maybe Newton’s second law of dynamics.”

D. James Backer, administrator of NOAA, cited in *Washington Post* (1997)

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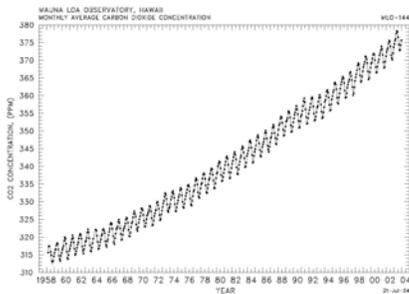
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### Atmospheric CO<sub>2</sub>



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## Early research

Svente Arrhenius

Nobel Prize (chemistry)

Doubling of atmospheric CO<sub>2</sub> → 5-6 C temperature increase (~ Ice Age – interglacial)

April 1896: *Philosophical Magazine* 41:237-276 (On the influence of carbonic acid in the air upon the temperature on the ground)

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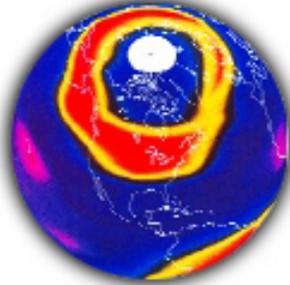
## Success stories

Air pollution  
Water pollution  
Ozone depletion

Kyoto and beyond?

~ 200 U.S. cities

Chicago climate exchange



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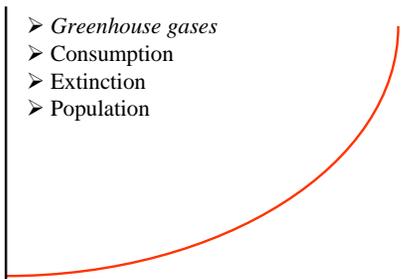
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## Four spikes\*

- Greenhouse gases
- Consumption
- Extinction
- Population



Time

\*Ed Ayres (1999) *God's Last Offer*

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## Greenhouse gases

Sources

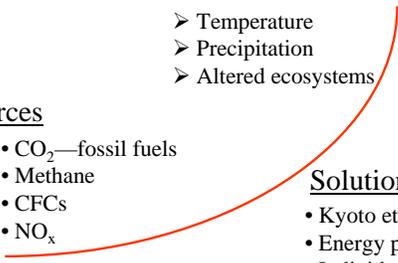
- CO<sub>2</sub>—fossil fuels
- Methane
- CFCs
- NO<sub>x</sub>

Outcomes

- Temperature
- Precipitation
- Altered ecosystems

Solutions

- Kyoto et al.
- Energy policy
- Individual actions




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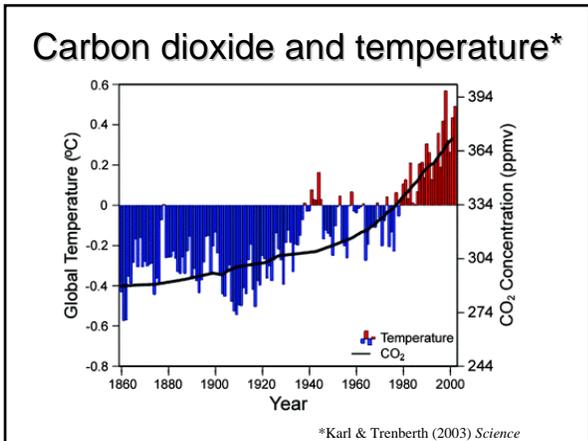
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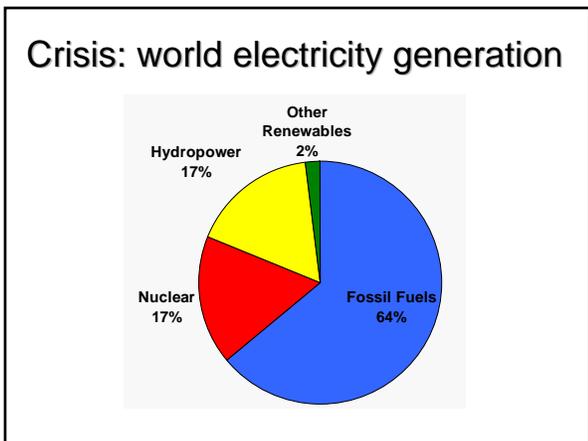
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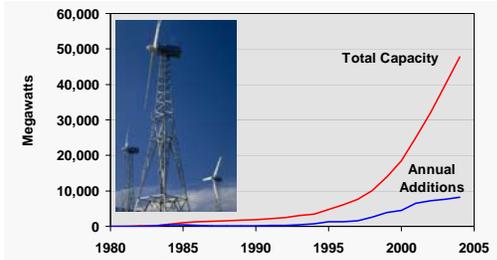
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## World wind power



\*Worldwatch Institute (2005) Trends

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## The nuclear non-solution



Chernobyl (1986)



Three Mile Island (1979)

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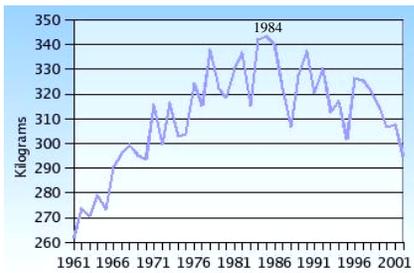
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## Environmental protection, social justice, and the human economy



Per Capita Grain Production\*

\*Worldwatch Institute (2003) Vital Signs

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## Greenhouse gases

Sources

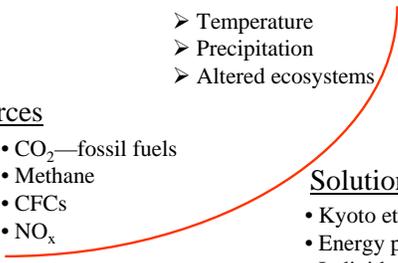
- CO<sub>2</sub>—fossil fuels
- Methane
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- NO<sub>x</sub>

Outcomes

- Temperature
- Precipitation
- Altered ecosystems

Solutions

- Kyoto et al.
- Energy policy
- Individual actions




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## GH gases—individual actions

- Transportation
- Energy

Nietzsche  
*Übermensch*  
*Selbstüberwindung*



The overman has left the building

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## “Don’t all parents want the world for their children?”\*

“To give them big houses, we will cut ancient forests. To give them perfect fruit, we will poison their food with pesticides. To give them the latest technologies, we will reduce entire valleys to toxic waste dumps. To give them the best education, we will invest in companies that profit from death. To keep them safe, we will deny them the right to privacy, to travel unimpeded, to peacefully assemble. And to give them peace, we will kill other peoples’ children or send them to be killed, and amass enough weapons to kill the children again, kill them twenty times if necessary.”

\*Kathleen Dean Moore (2004).  
*The Pine Island Paradox*, p. 117

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### Potential regional impacts

Precipitation:  
bimodal distribution

Pacific Decadal Oscillation (PDO)

Atlantic Multidecadal Oscillation (AMO)

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### Potential regional impacts

Precipitation:  
reduced during summer  
reduced during winter

increased intensity

→ reduced biological diversity

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### Impacts

- Increased temperature: 1.7-4.9 C by 2100\*
- Altered precipitation patterns
- Increased precipitation intensity
- Increased "severe" weather
- 150,000 deaths/year†

**Disease**  
**Heat waves**  
**Malnutrition**

\*Wigley & Raper (2001) *Science*  
†Patz et al. (2005) *Nature* 438:310-317 (17 November 2005)

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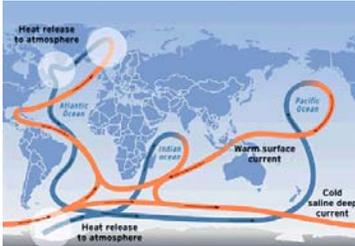
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## Thermohaline conveyor belt

North Atlantic water sinks (salty), flows south to Antarctica and branches into Indian and Pacific Basins

Warm water rises → upwelling (less salty) brings water to surface where it eventually returns to North Atlantic



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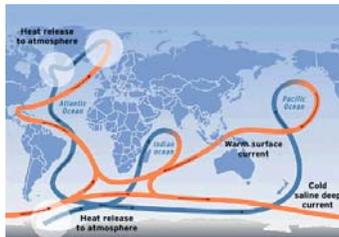
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## Tipping point\*

- Results from slowing of the ocean's thermohaline conveyor belt (due to Greenland's ice melting → lower salinity)
- Rapid climate change is a major threat to U.S. national security
- At least eight similar events in geological history of Earth



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## Tipping point

- Schwartz & Randall (2003) *Report to the Pentagon*
- Bryden et al. (2005) *Nature* 438:655-657 (December 2005):

“conveyor belt” has slowed 30% since 1957



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## Threats to national security

- Food shortages
- Water shortages
- Access to off-shore energy resources disrupted
- Human carrying capacity exceeded
- Resource wars
- Cf. "War on Terror"




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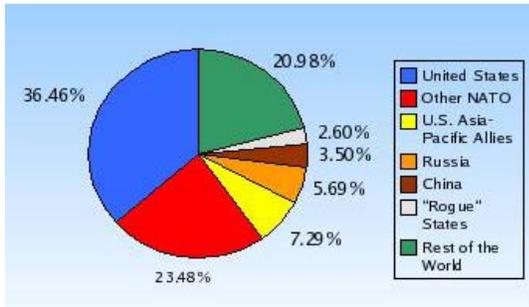
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## Military expenditures\*



\*Worldwatch Institute (2003) *Vital Signs*: 2001 data

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## U.S. expenditures vs. world needs\*

Military: >\$450 billion/yr (excludes Afghanistan, Iraq, >\$300 billion)

International aid: \$10 billion/yr

Needed to reach basic social goals:  
\$62 billion/yr

- Education
- Nutrition
- Health care
- Reproductive services

\*Lester Brown (2003) *Plan B*

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