

Beyond climate change

# Climate is changing...

- Can we stop it, if we wanted to?
- Do we want to stop it?
- Sustainability, the bigger picture

# Can we stop it?

- Carbon in the ocean will cycle back to the atmosphere
- Without mitigation, carbon from fossil fuels is “forever”
- Replacing fossil fuels will not happen immediately... it is reasonable to expect CO<sub>2</sub> levels to rise well beyond 400ppm

# Geoengineering

- We can sequester carbon dioxide...
- Remove it like other pollution from power plant smokestacks
- Local combustion (cars, homes, etc) is much harder to remove economically
- Direct removal from the atmosphere

# Geoengineering

- Once collected, the carbon must be stored somewhere
- The form can be liquid or solid
- Liquids can be stored below ground or in the ocean
  - Ocean storage will change ocean chemistry and ecology, and it is not permanent
  - Underground storage may not be permanent (leakage)

# Geoengineering

- Storage as a solid is more permanent... this is how nature stores carbon on the long term (carbonates, organics)
- Making solids is more costly, and the technology does not exist to do this on the scale required

# Geoengineering climate

- Other type of geoengineering is climate engineering
- Modify (lower) incoming solar radiation using mirrors or other reflectors in space or on land
  - Can climate be “chosen” in such a way?
  - Who chooses the climate?

# Simple geoengineering

- Grow more plants to sequester carbon
  - Competition with food and biomass energy crops
- Adapt
  - Move crop growing areas
  - Move coastal communities
  - etc

# Political solutions

- International meetings and agreements began in the 1980's, with COPs (Conference of the Parties), which tried to set limits on greenhouse gas production. For example, lets limit 2000 emissions to 1990 levels...
- These voluntary limits weren't working (and still aren't), so we (the "global we") went the next step to establish Protocols (Kyoto Protocol, for example) **which spelled out who was supposed to do what, and what the rules (*and penalties*) would be.**

# The rules (thus far)

1. A total, global cap on greenhouse gases will be effectively established ( $\text{CO}_2$ ,  $\text{CH}_4$ , CFC's  $\text{SF}_6$ ,  $\text{N}_2\text{O}$ ...); countries commit to a % reduction in GHG emissions
2. Countries are allowed to find individual ways to limit these (taxes, incentives, etc.)
3. The formation of groups of countries is encouraged

# The rules (thus far)

4. Credits can be taken for sequestering greenhouse gases (improve soils, grow trees, etc.)
5. Countries with developed economies are bound by the protocols, developing economies are exempted at this time.

# Kyoto Protocol

- The United States has not agreed to this (and is almost alone among developed countries in this regard).
- The reasons for this are political, economic, and practical.

# Kyoto Protocol

- Practical, for example: We want the following rule added:
- *If you are a developed economy, you can get credit for doing #4 in another country.*

# Kyoto Protocol

- The Europeans have fought this (they think we will try to buy our way out of limiting GHG's and effectively not deal with the core problem... reliance on fossil fuels... they also don't like rule #4 in general). This point is largely what blew up subsequent COP meetings.
- Also... we don't like that developing countries are exempted... a "fairness issue" (long debates lurk here about fairness).

# Kyoto Protocol

- Economic: We are the world's largest economy, and thus face the largest "hit" in implementing these rules.
- But, we also have have much (most?) to benefit

# Kyoto Protocol

## Political:

1. We don't like being told what to do by those outside of our borders... Americans are highly independent...
2. ...also, if the downside of climate change is not a big issue to Americans, our leaders will not expend political capital on the issue... see point #1

# Ethics

Typical motivations for changing our behavior:

1. economic
2. ethical and moral
3. Family, country or group loyalties
4. others...

# Ethics

- Right now, economics mostly “drives the decision bus”
- So if the net effect of climate change is not a loss of \$\$\$\$ , we are not likely to push our leaders to act. Neither are they likely to see this as a good step in managing the economy.

# Ethics

- But people are concerned about
  - the environment
  - about other species
  - about future generations
  - about cross national issues
  - about the poor, at home and abroad
- Climate change impacts all of these

# Ethics

- And an ethical dilemma has been brewing for some time...
- ...for 50,000+ years humans have been trying to tame the planet ("have dominion over the Earth")... in the last few decades or so we've finally recognized that we have achieved that goal... *and it's not very satisfying, and makes us much more directly responsible*

# Sustainability

- Climate change is just one challenge
  - Water
  - Minerals
  - Ecosystem services
  - Food
- We use resources as if they were infinite... they are not, nothing is.

# Sustainability

- Addressing climate change is part of a larger movement towards sustainable societies
- Energy is a basic need
- In addressing energy we will address population, cycling of resources, sustainable food production, etc.
- It will not take us all the way to sustainability, but it is a major step...

# The solution

- We are the biggest thing on the planet, the largest cause of changes in all of the fundamental parts of how our planet works.
- We have the intelligence to manage that power.
- We have the tools to manage that power
- Do we have the will to manage that power?

# The solution



# The solution

The solution is obvious:

Its you