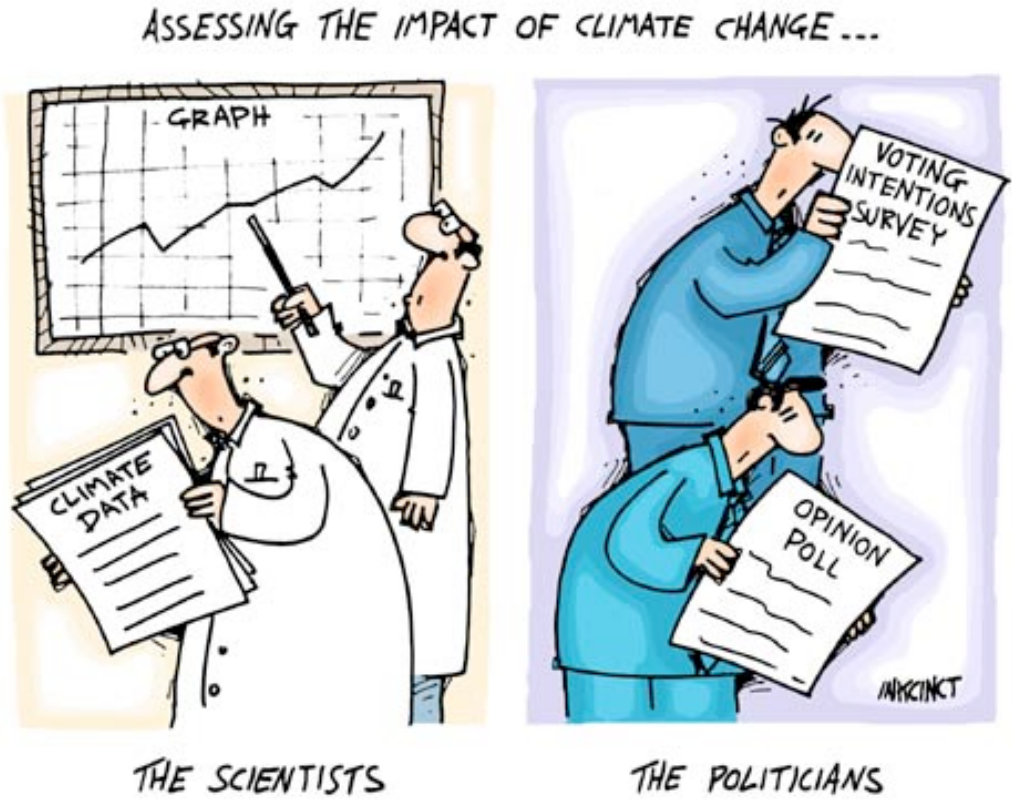
Responding to Climate Change

Gloom & Doom of Climate Change

What Can Be Done?

Final Project Stuff.



Global Warming – What Can Be Done?

Hypothetical….
Rob could lose a few pounds.

Possible Solutions? (good points & bad points)

Change Habits
- no more NYS Wieners

Medical Procedures
- Lipo-suck 4000

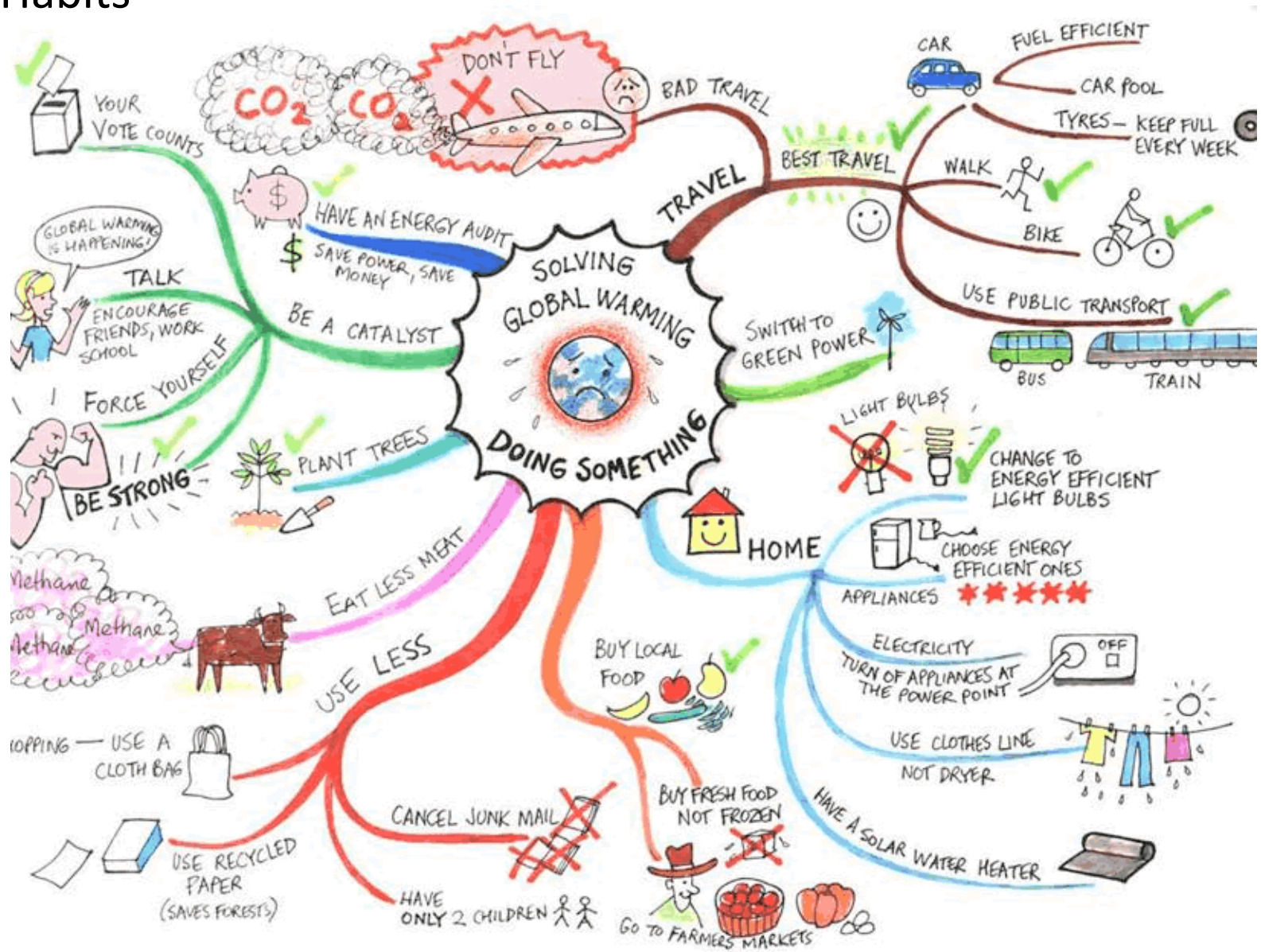
What can we do about Global Environmental Change?

Change Habits
- Reduce emissions

Geo-Engineering
- Human ingenuity

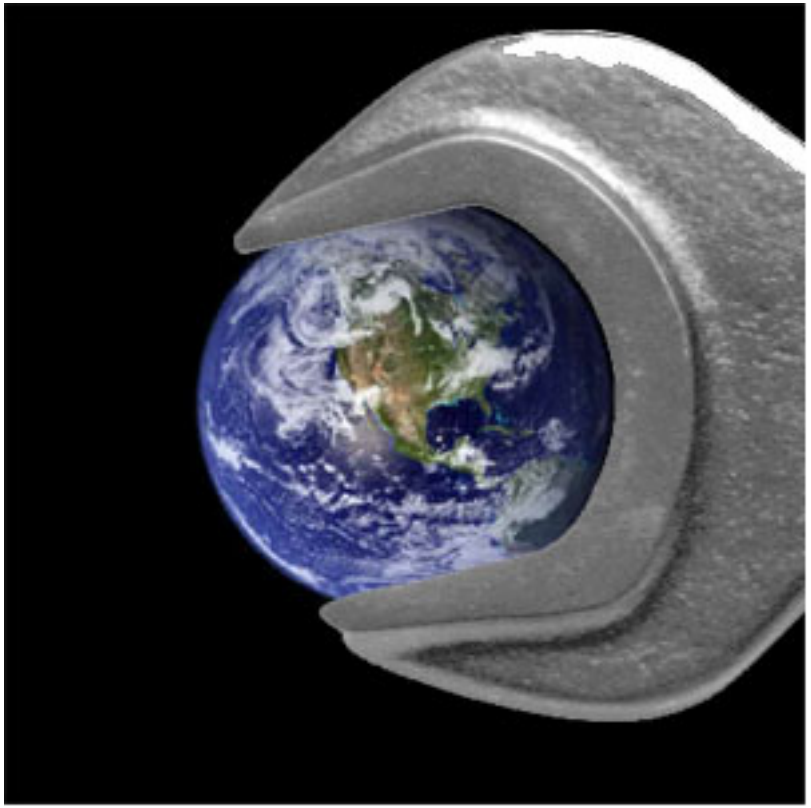
Global Warming – What Can Be Done?

Change Habits



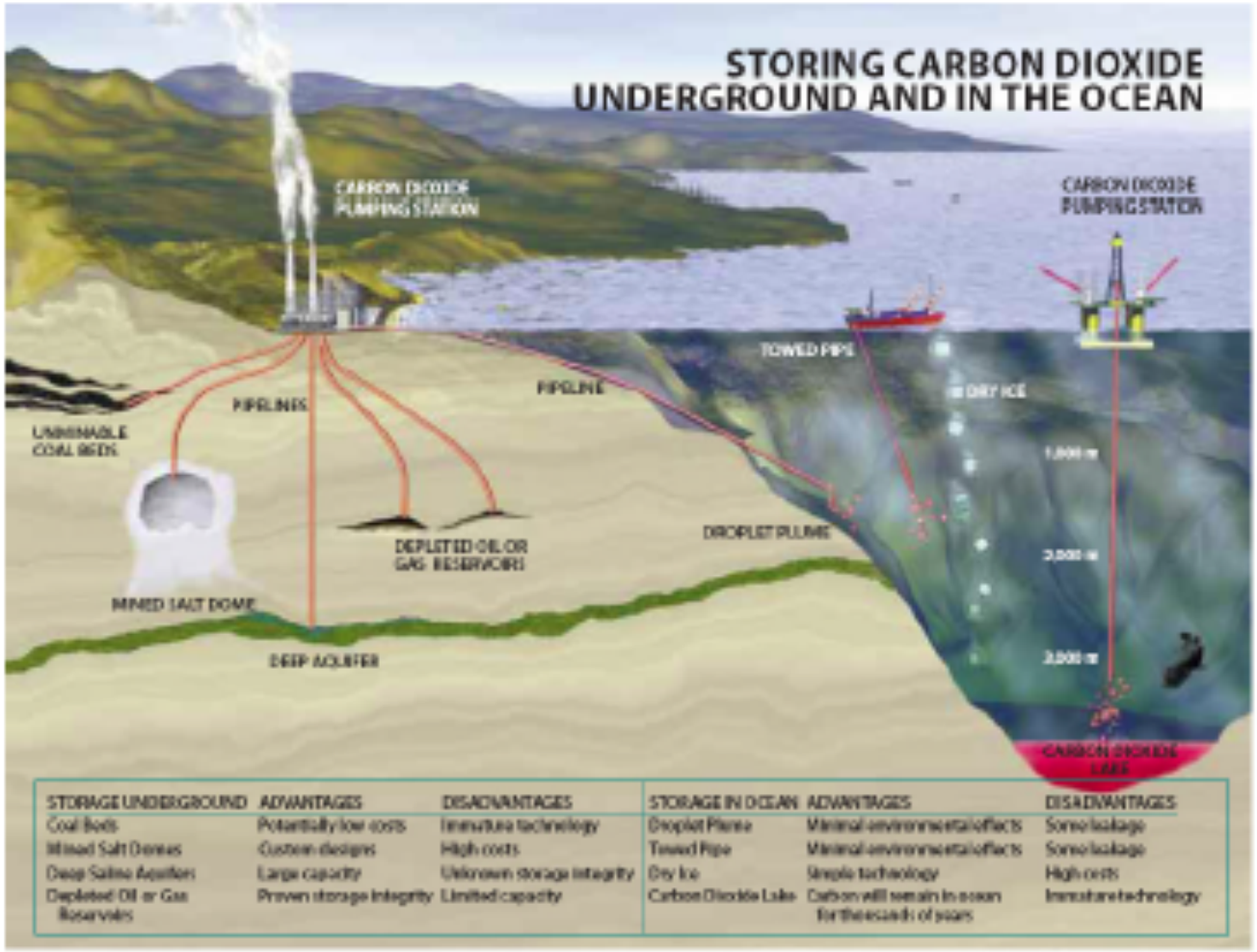
Global Warming – What Can Be Done?

Geo-Engineering



Global Warming – What Can Be Done?

Where to Place the Sequestered Carbon?



STORAGE UNDERGROUND	ADVANTAGES	DISADVANTAGES
Coal Beds	Potentially low costs	Immature technology
Mined Salt Domes	Custom designs	High costs
Deep Saline Aquifers	Large capacity	Unknown storage integrity
Depleted Oil or Gas Reservoirs	Proven storage integrity	Limited capacity

STORAGE IN OCEAN	ADVANTAGES	DISADVANTAGES
Droplet Plume	Minimal environmental effects	Some leakage
Towed Pipe	Minimal environmental effects	Some leakage
Dry Ice	Simple technology	High costs
Carbon Dioxide Lake	Carbon will remain in ocean for thousands of years	Immature technology

STORAGE SITES for carbon dioxide in the ground and deep sea should help keep the greenhouse gas out of the atmosphere where it now contributes to climate change. The various options must be scrutinized for cost, safety and potential environmental effects.

Herzog *et al.*, *Scientific American*, 2000

Global Warming – What Can Be Done?

CO_2 Capture and Storage (CCS) Costs:

CCS component	Cost range	
Capture from a power plant	15–75 US$/tCO$_2$ net captured	~$45/ ton
Capture from gas processing or ammonia production	5–55 US$/tCO$_2$ net captured	
Capture from other industrial sources	25–115 US$/tCO$_2$ net captured	
Transportation	1–8 US$/tCO$_2$ transported per 250km	~$4.5/ ton
Geological storage	0.5–8 US$/tCO$_2$ injected	~$4.5/ ton
Ocean storage	5–30 US$/tCO$_2$ injected	
Mineral carbonation	50–100 US$/tCO$_2$ net mineralized	

Cost of capture: ~**$54 / ton** $CO_2 \times 9.1 \times 10^9$ tons C / yr = **$ 491 billion**

Present cost of fossil fuel: $ 103 / barrel = **$889 / ton**

World GDP, 2010: **$ 63.1trillion** CO_2 capture= 0.8 % of world GDP = 6 % of cost, barrel of oil

⇧ Ross & Tim back of the envelope analysis

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

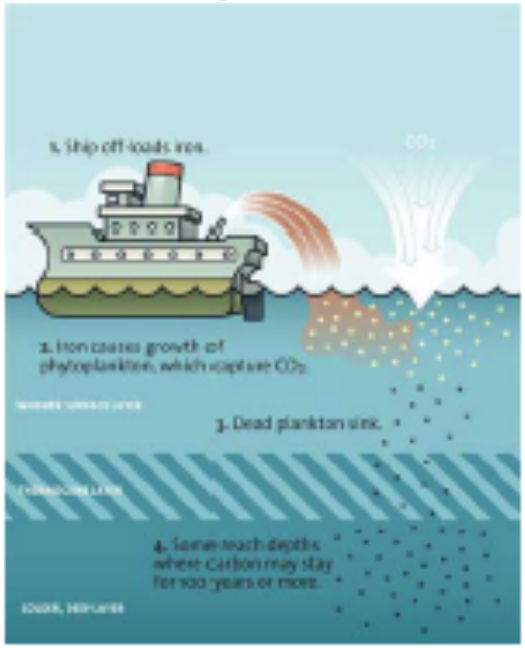
WMO UNEP

Carbon Dioxide Capture and Storage

Global Warming – What Can Be Done?

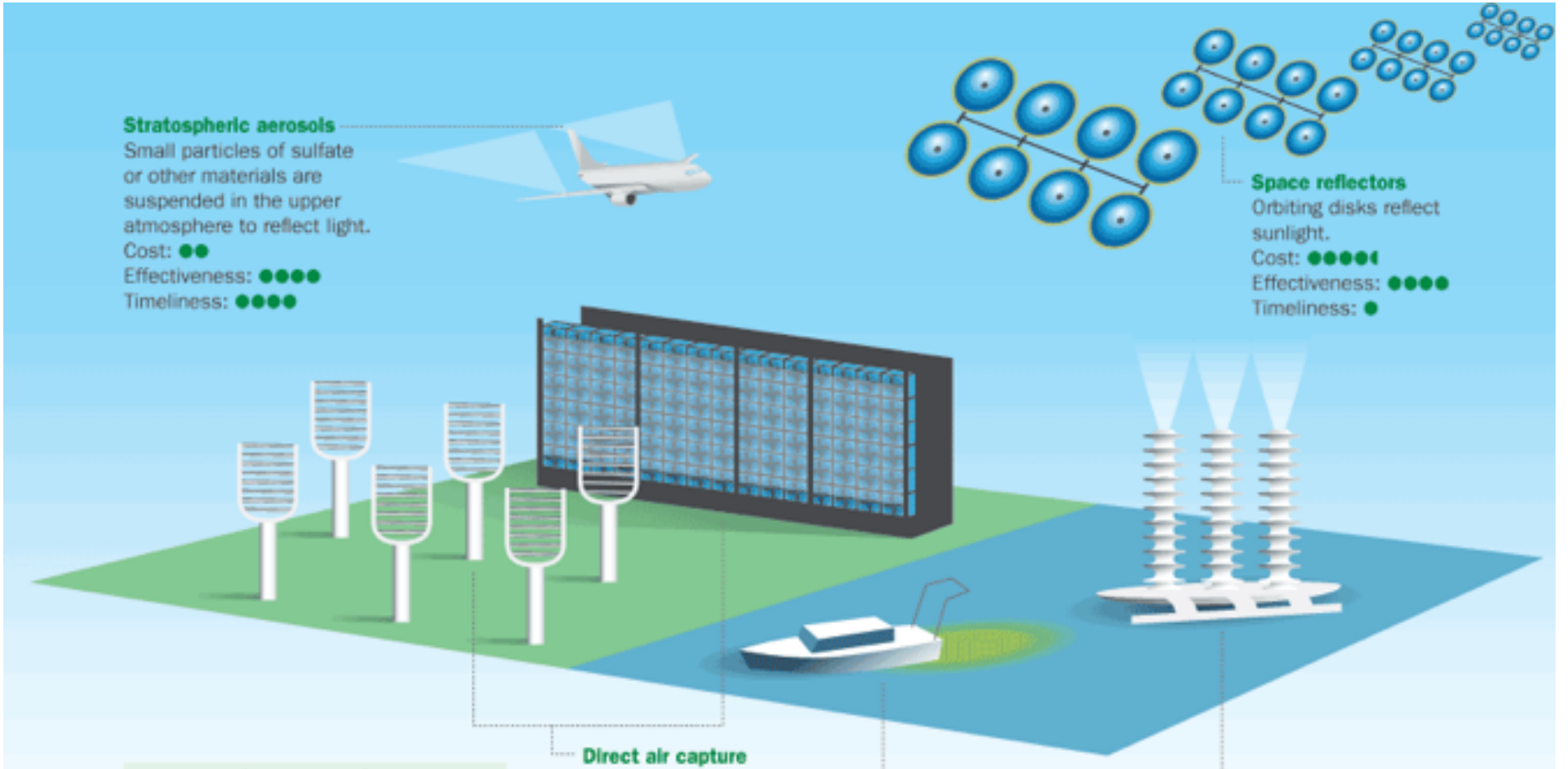
Sequestration of CO_2 from the Atmosphere: Oceanic Biology

- Iron's importance to phytoplankton growth and photosynthesis in the ocean dates back to the 1930s, when English biologist Joseph Hart speculated that the ocean's great "desolate zones" (areas apparently rich in nutrients, but lacking in plankton activity or other sea life) might be due to an iron deficiency
- This observation has led to speculation by numerous scientists that "tanker loads" of iron powder, deposited in the right place and time, would increase oceanic dissolved iron content enough to turn these "desolate regions" into oceanic biological havens



http://www.motherjones.com/files/legacy/news/outfront/2008/03/dumping-iron-1000.jpg

Global Warming – What Can Be Done?



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Cost	Cheap	Expensive
Effectiveness	Little cooling effect	Strong cooling effect
Timeliness	Slow-acting and/or slow to deploy	Fast-acting and/or quick to deploy

Five ways to save the planet The United Kingdom's Royal Society has rated geoengineering techniques according to cost, effectiveness (cooling power) and timeliness (considering both how quickly a technology could be deployed and how fast it would cause cooling).

Modeling & Responding to Climate Change

Gloom & Doom of Climate Change
- sea level rise, drought, floods, severe weather, disease

What Can Be Done?
- change behavior
- geo-engineering

Modeling & Responding to Climate Change

Gloom & Doom of Climate Change
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What Can Be Done?
- change behavior
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1
Tarczuk, Garrett
Spentzos, Niko
Ragosta, Alyssa
Rowe, Brenny
Ryng, Maggie

2
Murphy, Elizabeth
Butler, Bill
Williams, Mike
Samuel, Kufre

3
Duong, Jasmine
Schram, Emma
Coppola, Domenic
Goldthwaite, Leo

4
Messier, Chris
Riel, Hannah
Fordham, Taylor
Pinkrah, Michael

5
Tissiere, Sean
Brocks, Alexandra
Bayne, Patrick
Porreca, Nicholas

6
MacDonald, Madison
Boden, Bryan
Fernandes, Dominic
Wilner, Jeremy

7
Marriott, Jacq
Chen, Vince
Gonzalez, Jescenia
Yanaros, Michelle

8
Richard, Gavin
Punsalan, Christopher
Courage, Sean
Smith, Joe

9
Sylvia, Lindsay
Grande, Payton
Smith, Juliette
Bademosi, O.J

10
Okokon, Itoro
Marriott, Rachel
Tessier, Curtis
Filippini, Joe

11
Garvey, James
Olowoporoku, Elizabeth
Schuelke, Dylan
Delisle, Jordan

12
Peccia, Joe
Gorman, Jessie
Sanchez, Andrew
Johanning, Nathan

13
Blais, Abby
Corbin, Rich
DeCastro, Michael
Smith, Jess

14
Phomsouvan, Howie
Palmer, Ben
Day, Jack
Adutwum, Kwa

Global Warming
- recreation (no skiing projects)
- heat waves
- shifting ecosystems

Sea Level Rise Impacts
- U.S. military
- Pacific Islands
- Florida, Virginia, Rhode Island
- recreation

Extreme Weather Occurrence
- lake effect storms
- nor'easters
- hurricanes
- blizzards
- droughts

Ecosystem Disruption
- plants (kudzu, Japanese barberry)
- animals (zebra mussels, lionfish, snakehead, pythons, feral hogs)
- insects (emerald ash borers, nutria, stink bugs

Expanding Disease Range/Occurrence
- Mosquito-borne (Zika, Malaria, West Nile, Dengue Fever)
- Anthrax
- Tick-borne diseases (Babesia, Lyme)
- Cholera

Corporate Globalization
- environmental protection differences between countries
- cheap labor and affordability of goods
- likelihood of armed conflicts
- cultural differences
- sharing of information
- growth of developing countries