One way of looking at possible future climate change pathways

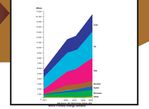
Today 2008

Global average temperatures now 0.5 degrees Centigrade (above pre-industrial levels)

Business As Usual Path

Driving forces of inertia, special interest profits, denial, implementation delays

World energy demand will grow about 40% by 2030 in a "business as usual" scenario



Locked into Business As Usual Path

Uncertain variable timing
as early as 2020

Early warning shocks possibly occur

i.e. any or all of the following become a frequent occurrence:
- material damages in excess of $500 billion [or]
- more than 30 million displaced persons [or]
- deaths over 10 million directly or indirectly caused by climate related phenomena

Example: 4 or 5 Katrina-like events within 10 or 5 years

Uncertain variable timing
as early as 2045

Interaction of multiple "Tipping Points" begin to trigger possible runaway cascades

Global average temperatures pass 3 degrees Centigrade (above pre-industrial levels) 5.4 degrees Fahrenheit

Forced transition to clean energy path

Uncertain variable timing
as early as 2045

More rapid, abrupt, and dangerous climate change phenomena begin

Examples
- Widespread drought
- Rapid melting of glaciers
- Monsoon shifts
- Severe water shortages
- Shifts in warm ocean currents

...and if we're *lucky* the early warning shocks happen early enough...

...the world makes rapid implementation of clean energy polices

Scientists document clear indications that tipping point cascades have begun

Uncertain variable timing
Maybe as early as 2055

Very messy but localized economic and political effects, disruptions

Examples
- Regional wars over water, food, and mass migration.
- Potential genocide.
- Regional economic stagnation and downturn
- Serious regional epidemics
- Serious regional famines
- Mass migrations

Schwartz and Randall (2003) and the Center for Health and Global Environment (2006)

Uncertain variable timing
Maybe as early as 2065

Localized tensions strain global relations and lead to possible widespread chaos

Examples
- Possible large-scale wars over water, food, and mass migrations
- Permanent disruption of large urban areas

?

World leaders find that the tipping points and abrupt climate change phenomena are happening and are so threatening that geo-engineering is the only chance to prevent changes in the climate system that are dangerous for humanity

Uncertain variable timing
as early as 2045-2065

Geo-engineering path

Large geo-engineering planet-wide projects begun by countries either separately or together

Examples:
- Spread suphates inthe stratosphere to block sunlight
- Deploy large array of mirrors in space to deflect sunlight

...we're *lucky* that the geo-engineering works as planned in time

Clean Energy Path

***Prompt and successful Implementation of* major changes to clean energy use**

For the world

Substantially reduce emissions of greenhouse gases 80% or more below 1990 levels by 2050; and promptly make a strong post-Kyoto agreement that would include
- economic disincentives for greenhouse gas emissions, such as "emitter pays" schemes or carbon taxes
  and
- economic incentives for preserving natural carbon sinks such as rain forests
- economic incentives for rapidly developing countries like China, India, and Brazil to immediately begin using best available technologies for renewable energy and clean coal

For the USA

Promptly adopt clean energy policies that would include
- cap and trade system
  or
- carbon tax to reduce emissions of greenhouse gasses 80% or more below 1990 levels by 2050
  and

implement massive renewable energy infrastructure
and
implement an Apollo-like project to change energy generation and use

Clean Energy (Maybe Just in Time) Path

Lack of political will and vision; constraints of political institutions

...the world political system, with the help of the political will of its citizens, successfully maintains commitments to an implementable agreement soon enough...

Forces of inertia; special interest profits; denial; implementation delays

Near Term (i.e. by 2050) outcome
Long-term binding international agreements to avert dangerous interference witht the climate system
The world is committed to implementing solutions

Currently US budgets for clean energy and other climate change mitigation R&D have been decreasing

Climate Change Research Path

R&D breakthroughs on clean energy systems, carbon capture and storage, and behavior change about energy consumption occur *that can be implemented in time to prevent dangerous interference with the climate system*

We're lucky – energy researchers make discoveries soon enough

WILD CARD
Very uncertain variable timing

Peak oil happens soon enough that high oil prices incentivize the world to switch to low/no carbon fuel sources (not coal)

Peak Oil increases use of coal that in turn increases CO2 emissions that increase global warming

Oil production peaks

WILD CARD
Very uncertain variable timing

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V.16