Climate Change Solutions

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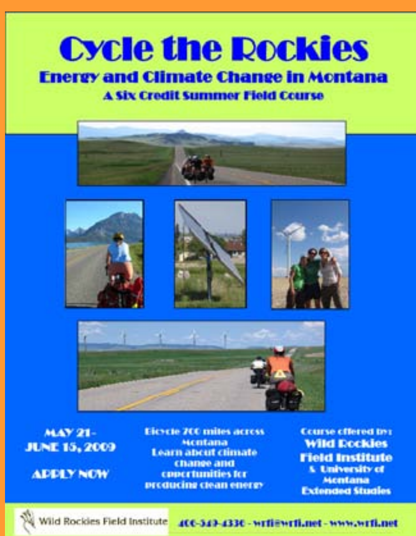
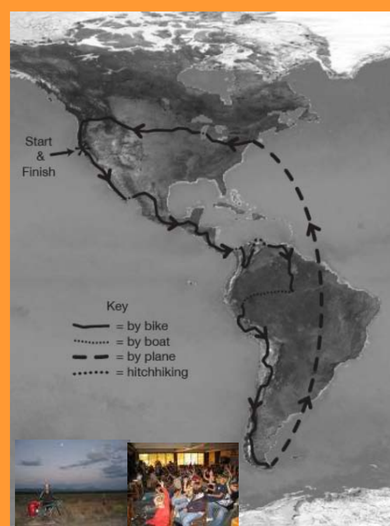
November 16, 2009



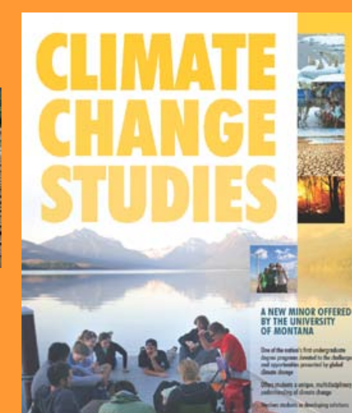
2006



2007

I·C·L·E·I
Local
Governments
for Sustainability

2008



2009

Climate Events This Week

- **<u>Tuesday, November 17</u>**
  UM Climate Action Plan Open House
  3:00 pm, University Center Theater, 3rd Floor UC Center
  Sponsored by the UM Office of Sustainability.
  * The UM is in the process of creating a Climate Action Plan to analyze and prioritize strategies to reduce its emissions. The plan addresses the three largest sectors of UM carbon dioxide emissions: purchased electricity, transportation, and energy on campus from the steam co-generator. This Open House provides an opportunity to learn about and comment on the draft; the comment period will continue until December 1.

- **<u>Tuesday, November 17</u>**
  A Community Discussion of Global Cap and Trade
  7:30 pm, University Center North Ballroom, 3rd Floor UC Center
  * Landon Vandyke - former Associate Director of International Affairs and Climate Change for the White House Council on Environmental Quality and current special advisor at the U. S. Department of State
  * Murali Kanakasabai - VP and senior Economist with the Chicago Climate Exchange
  * Keegan Eisenstadt - CEO and President of Missoula's ClearSky Climate Solutions.
  Sponsored by The Sustainable Business Council and The MontanaWorld Affairs Council.

- **<u>Wednesday, November 18</u>**
  Down to the Wire: Confronting Climate Collapse
  8:00 pm, University Center North Ballroom, 3rd Floor UC Center
  Dr. David Orr, Professor of Environmental Studies and Politics
  Sponsored by the President's Lecture Series and Brennan Guth Memorial Lecture in conjunction with the EVST program.

- **<u>Thursday, November 19</u>**
  Spring Semester Climate Change Internship Opportunities – An open forum for students
  5:00-6:00 pm, Main Hall, Room 210
  Sponsored by the Climate Change Studies Program.
  Students interested in doing a climate change-related internship next spring are welcome to attend this forum to learn about available opportunities and meet potential supervisors. Details are on the <u>CCS website</u> for students who cannot make it to the forum.

Climate Change

How would you define the climate problem?

What solutions exist?

How would you evaluate solutions?

How would you define the climate problem?

"The problem of climate change starts with the actions of people and ends with the actions of people." ~Nicholas Stern in The Global Deal

Particularly complex:

- Externality is long term
- It is global
- It is potentially of a huge scale

What solutions exist and how would you evaluate them?

Existing Solutions:

- Emit Less (use less, become more efficient in what use, use fewer fossil fuels)
- Improve the absorptive capacity of the land (forests, soils, oceans)
- Geoengineer to remove CO2 and cool the planet
- Adapt
- Suffer

Solutions must be:

- Effective
- Efficient
- Equitable

Test # 3 Questions

(1) Elevator Talk

- Why do you care about climate change (consider why you see it as a problem, and the framing you use)
- What you think should be done about it (solutions)
- How you want to participate in/engage with solutions

(2) Climate Stabilization and Wedge Solution

- What target should we set and why?
- How many wedges will this require, and which ones do you think we should use? Fill in the Stabilization Triangle.
- Evaluate your solution based on its effectiveness, efficiency, and equity. Consider various global stakeholder groups, such as the auto industry, taxpayers/consumers, an environmental advocacy organization, a developing country, or the US. Judging ensures that economic and political impacts are considered and emphasizes the need for consensus among a brad coalition of stakeholders.

***You are welcome, and in fact encouraged, to work with others to formulate your answers.**

Climate Stabilization and the Wedge Solution

A Concept and Game

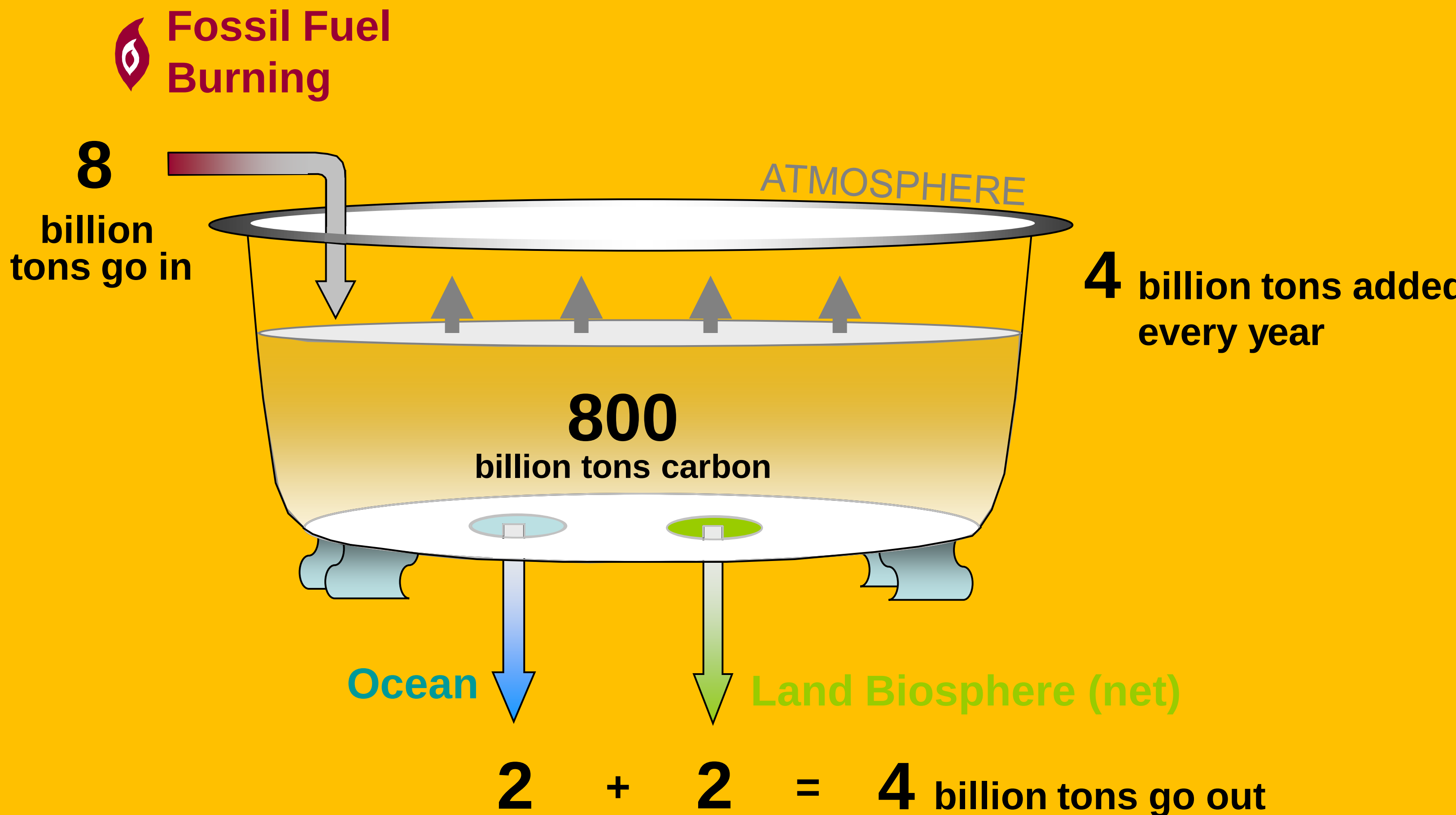
This presentation is based on the “Stabilization Wedges” concept first presented in

"Stabilization Wedges: Solving the Climate Problem for the next 50 Years with Current Technologies,” S. Pacala and R. Socolow, Science, August 13, 2004

And presentation available at: http://cmi.princeton.edu/wedges/

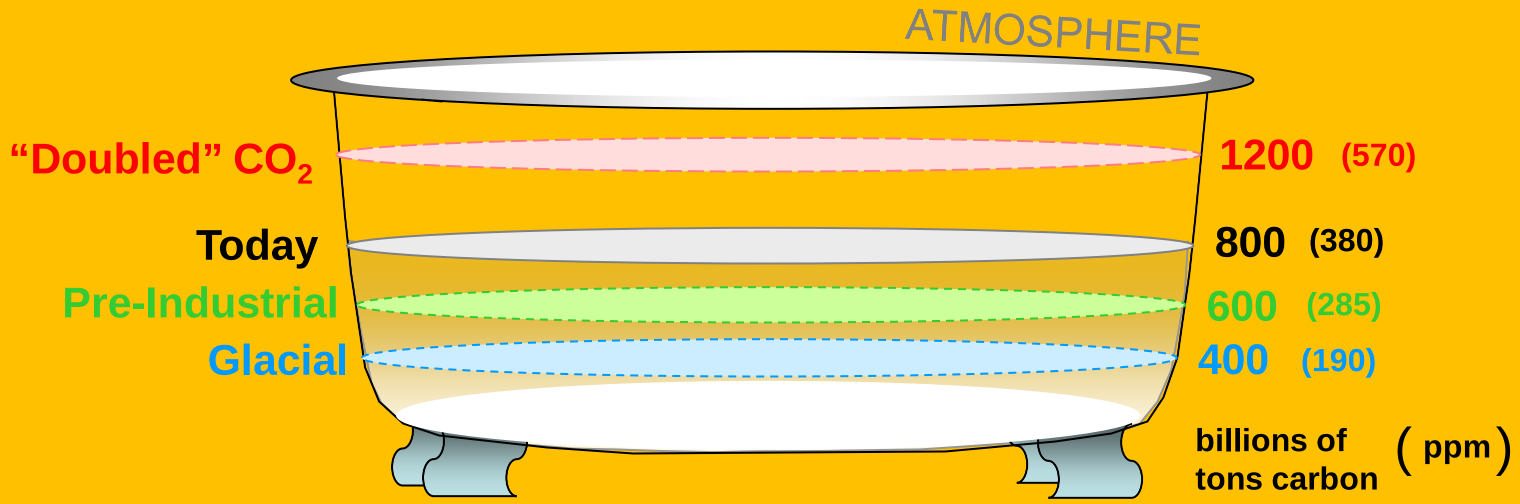
CMI
Carbon Mitigation Initiative

PEI
PRINCETON
ENVIRONMENTAL
INSTITUTE

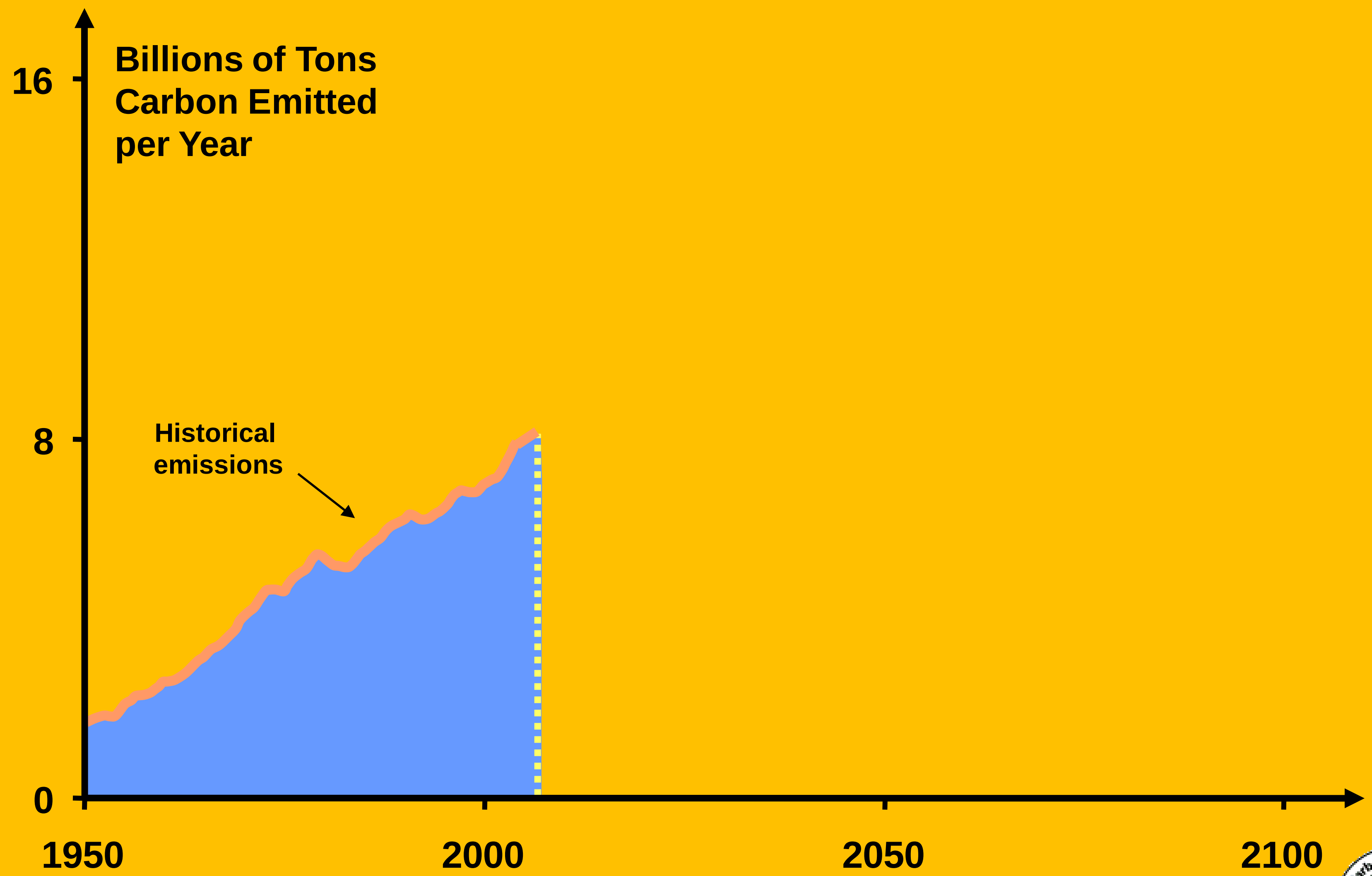


Fossil Fuel
Burning
8
billion
tons go in
ATMOSPHERE
4 billion tons added
every year
800
billion tons carbon
Ocean
Land Biosphere (net)
2 + 2 = 4 billion tons go out

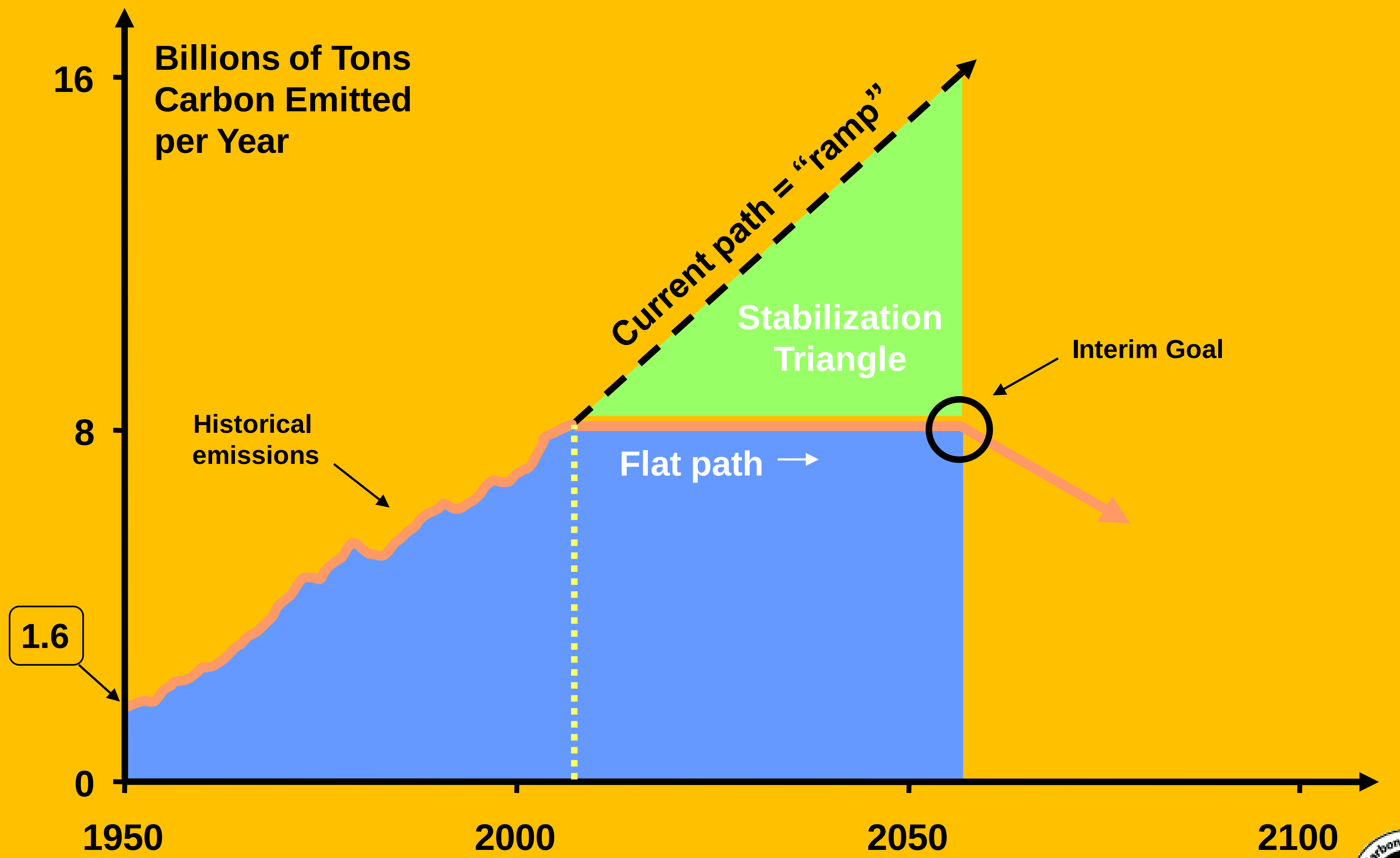
Past, Present, and Potential Future Carbon Levels in the Atmosphere



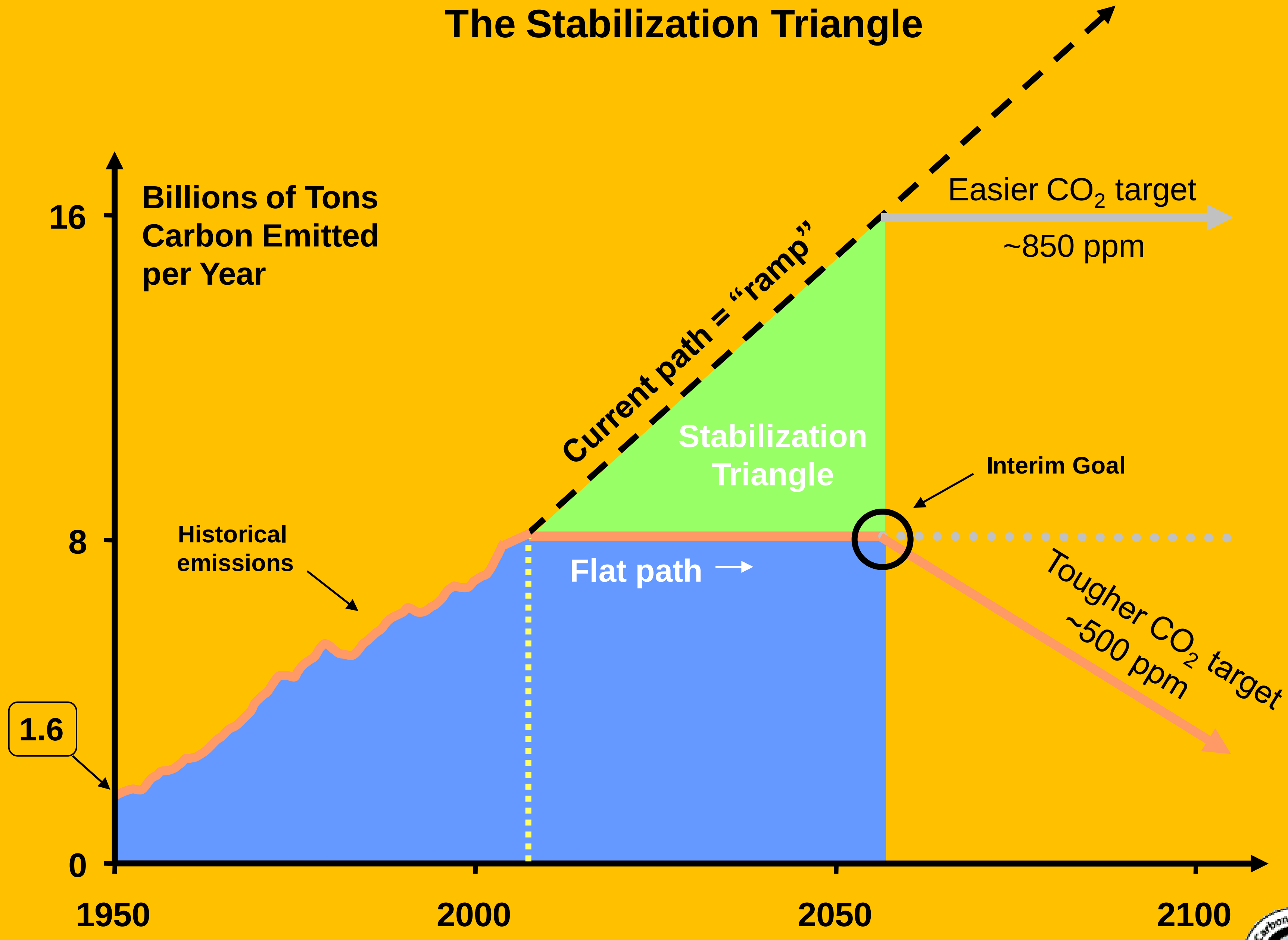
Historical Emissions



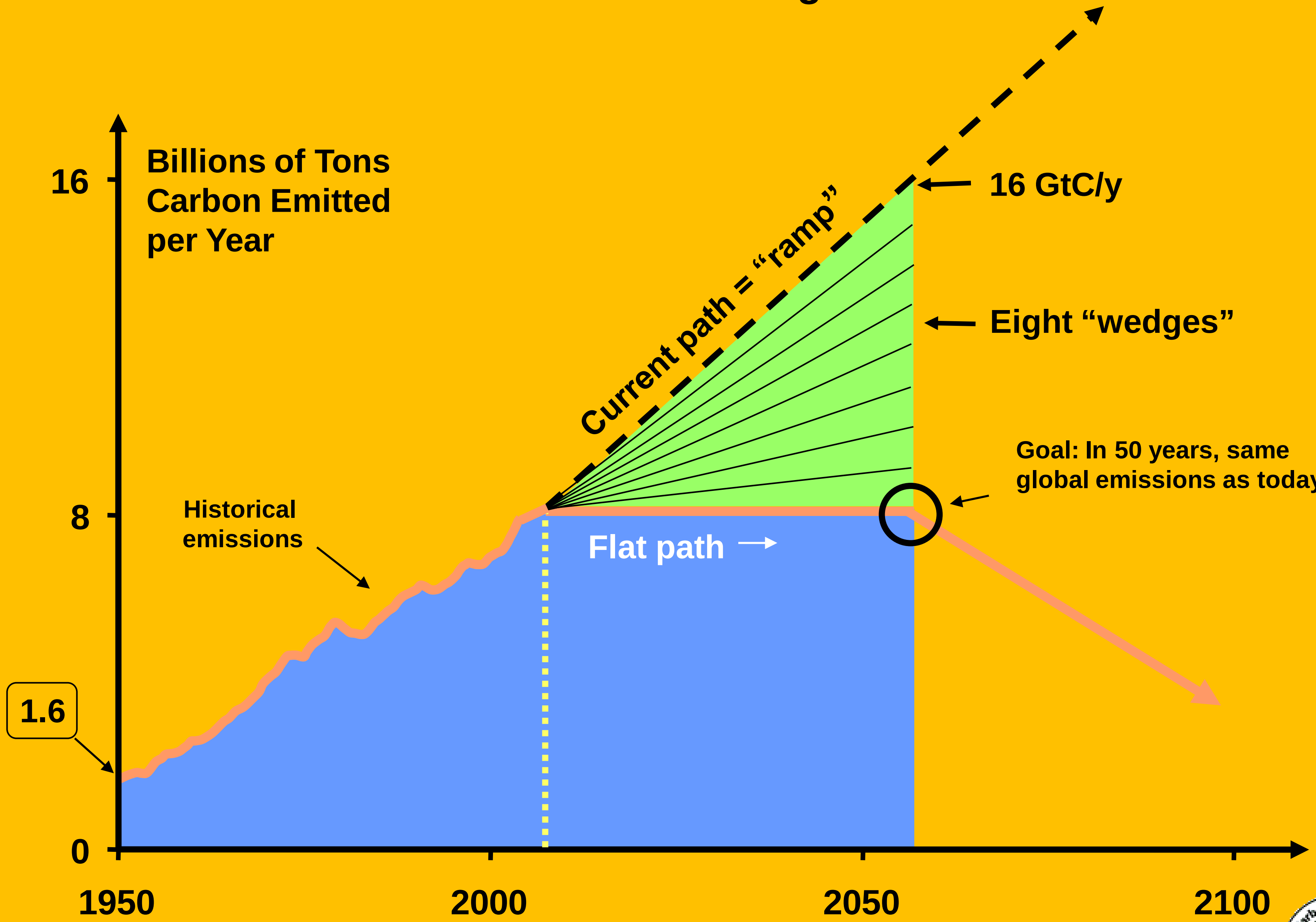
The Stabilization Triangle



The Stabilization Triangle



Stabilization Wedges

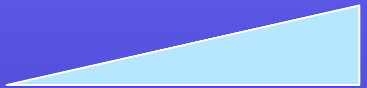


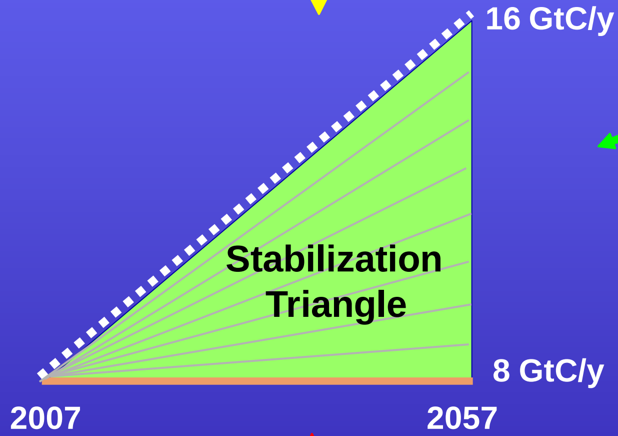
15 Wedge Strategies in 4 Categories

Energy Efficiency & Conservation (4)

Fuel Switching (1)

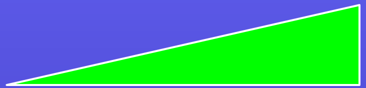
CO_2 Capture & Storage (3)



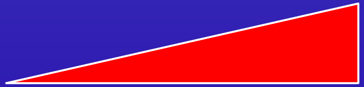


Renewable Fuels & Electricity (4)

Forest and Soil Storage (2)



Nuclear Fission (1)



Efficiency

Double the fuel efficiency of the world's cars <u>or</u> halve miles traveled

There are about 600 million cars today, with 2 billion projected for 2055

Produce today's electric capacity with double today's efficiency

Average coal plant efficiency is 32% today

Use best efficiency practices in all residential and commercial buildings

Replacing all the world's incandescent bulbs with CFL's would provide 1/4 of one wedge

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Wind Electricity

Install 1 million 2 MW windmills to replace coal-based electricity,

OR

Use 2 million windmills to produce hydrogen fuel

A wedge worth of wind electricity will require increasing current capacity by a factor of 30

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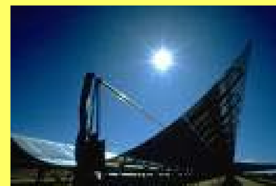
Solar Electricity



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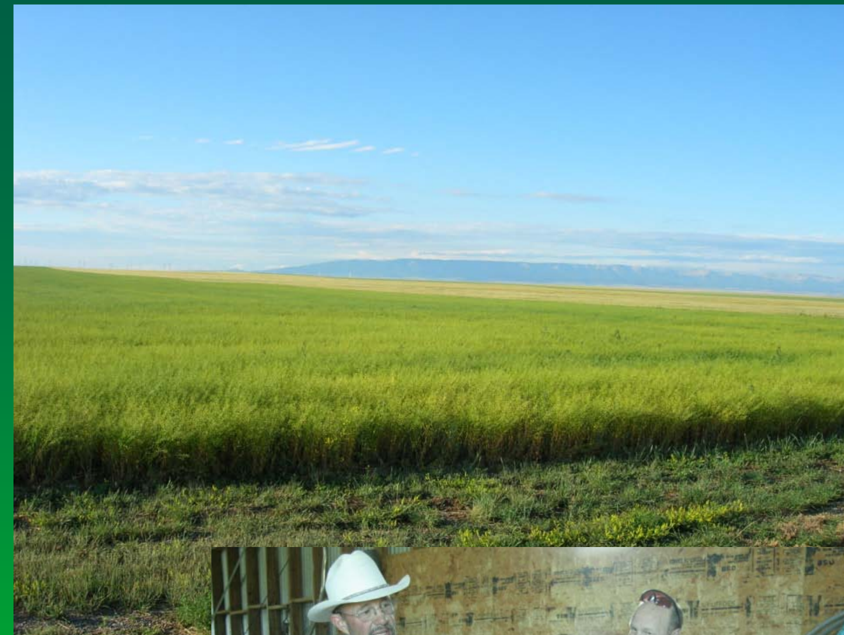
A wedge of solar electricity would mean increasing current capacity 700 times

Biofuels

Scale up current global ethanol production by 30 times



Using current practices, one wedge requires planting an area the size of India with biofuels crops

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Natural Sinks

Eliminate tropical deforestation

OR

Plant new forests over an area the size of the continental U.S.

OR

Use conservation tillage on *all* cropland (1600 Mha)

Conservation tillage is currently practiced on less than 10% of global cropland

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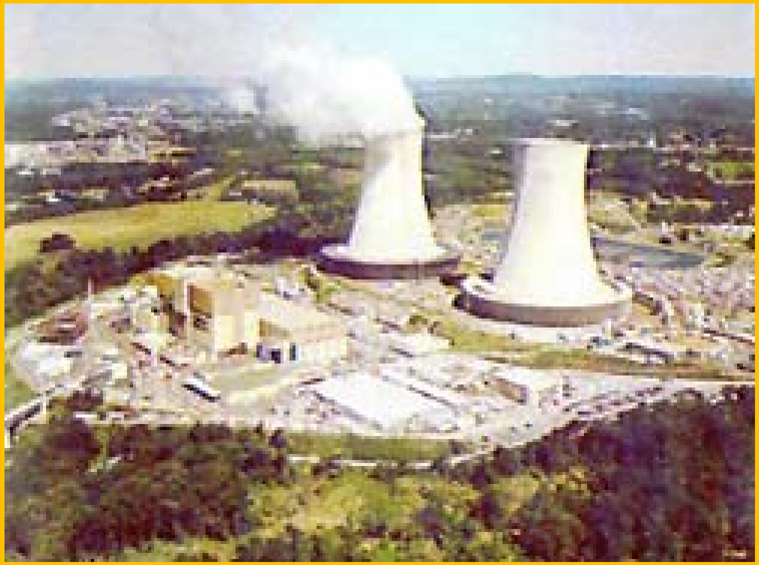
Nuclear Electricity



Triple the world's nuclear electricity capacity by 2055

The rate of installation required for a wedge from electricity is equal to the global rate of nuclear expansion from 1975-1990.

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Fuel Switching

Substitute 1400 natural gas electric plants for an equal number of coal-fired facilities

A wedge requires an amount of natural gas equal to that used for all purposes today

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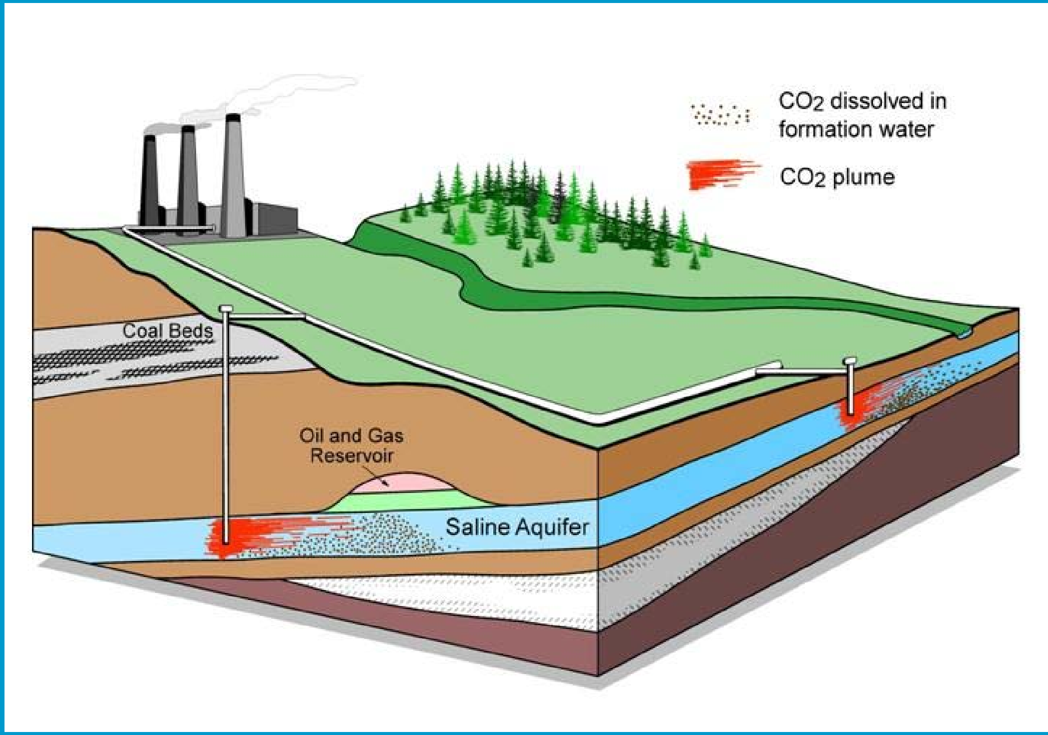
Carbon Capture & Storage



Implement CCS at

- 800 GW coal electric plants or
- 1600 GW natural gas electric plants or
- 180 coal synfuels plants or
- 10 times today's capacity of hydrogen plants

There are currently three storage projects that each inject 1 million tons of CO_2 per year – by 2055 need 3500.

$ $

Take Home Messages

- In order to avoid a doubling of atmospheric CO_2, we need to rapidly deploy low-carbon energy technologies and/or enhance natural sinks
- We already have an adequate portfolio of technologies to make large cuts in emissions
- No one technology can do the whole job – a variety of strategies will need to be used to stay on a path that avoids a CO_2 doubling
- Every “wedge” has associated impacts and costs