

Climate Change Solutions

Nicky Phear
November 10, 2010

Cycle the Rockies
Energy and Climate Change in Montana
A Six Credit Summer Field Course

Start & Finish

Key
 — = by bike
 = by boat
 - - - = by plane
 = hitchhiking

MAY 21 - JUNE 15, 2009
APPLY NOW

Cycle 700 miles across Montana
Learn about climate change and cause families to produce clean energy

Course offered by
Wild Rockies Field Institute
& University of Montana
Extended Studies

Wild Rockies Field Institute 406-543-4336 wrfi.wrfi.net www.wrfi.net

2006



2007

CLIMATE CHANGE
MOVING FROM SCIENCE TO SOLUTIONS

The 2008 Wilderness Issues Lecture Series
February-April 2008
University of Montana
Grey Underground Lecture Hall

Free and open to the public

Available by Email: 900@wri.net

- 15. The Green Economy, Energy, and the Role of Forests: An Advancing Center for Climate Change Research, Introduction and Introduction to the Green Economy and the Forest Economy
- 16. Developing Climate Change Adaptation on the Ground: The Landmark Experience
- 17. The Green Economy: A New Paradigm for the 21st Century
- 18. Law and Climate Change: Developmental Approaches, Fuel Requirements, and Work
- 19. The Green Economy: A New Paradigm for the 21st Century
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ETHICS
The University of Montana

2008



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Local Governments for Sustainability

CLIMATE CHANGE STUDIES

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The University of Montana

2009

Climate Change

Why is climate change a problem?

What solutions address this problem?

How would you evaluate solutions?



Defining the Climate Change Problem

climate change is problem x and g (thesis) + climate change is problem l and b (antithesis) = synthesis.

Or: climate change is problem x and this is the solution to solving problem x

Dialectic approach: Climate change is a problem because it threatens human populations (thesis) + climate change is not a problem because there are too many humans and they are destroying the planet (antithesis) = synthesis?

Pragmatic approach: Climate change is a problem because it threatens human and other populations = solution.

Exam #3 Questions

(1) Elevator Talk

- Explain why you think climate change is a problem,
- what you think should be done about it,
- and 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 be use?

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

Climate Stabilization and the Wedge Solution

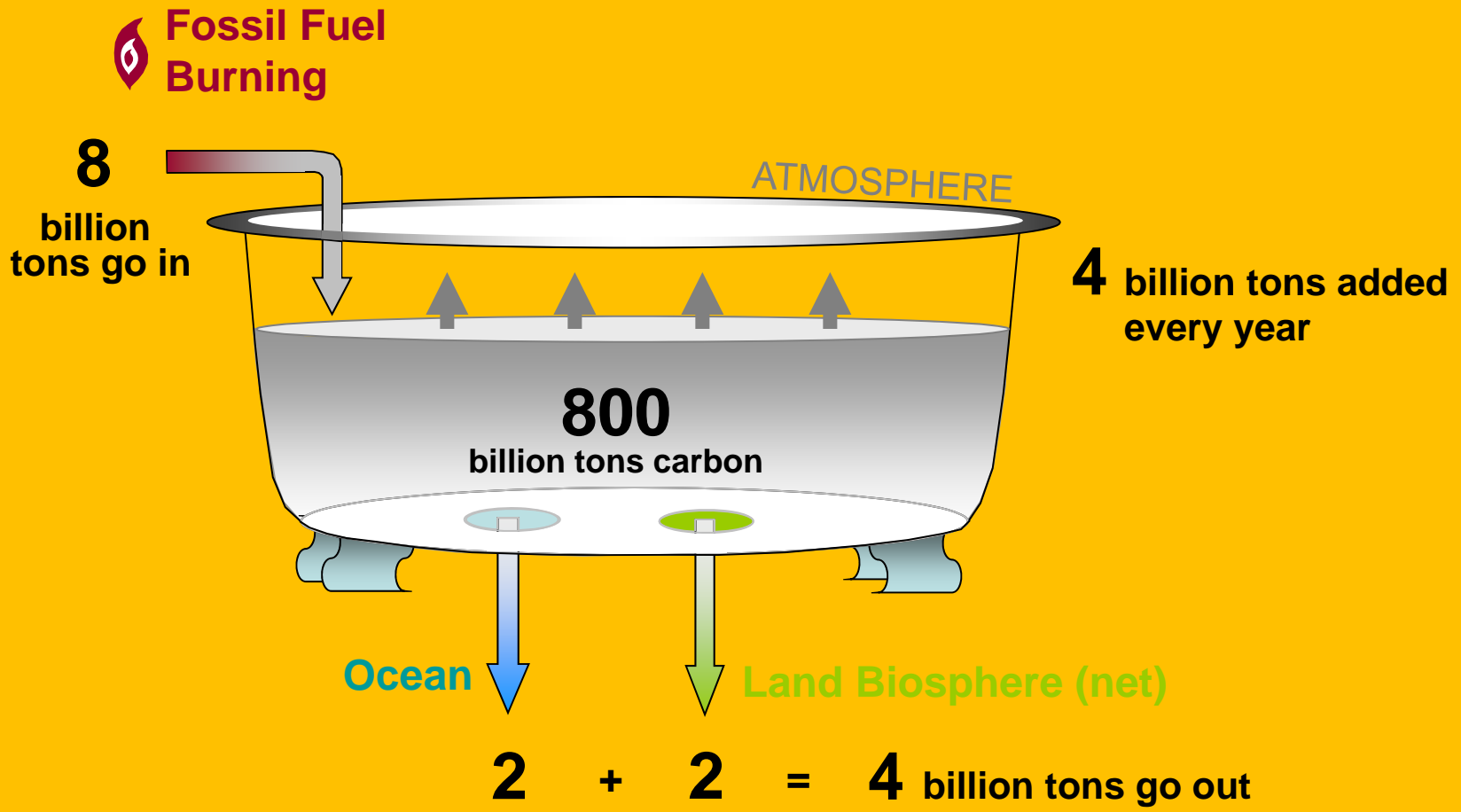
A Concept and Game

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

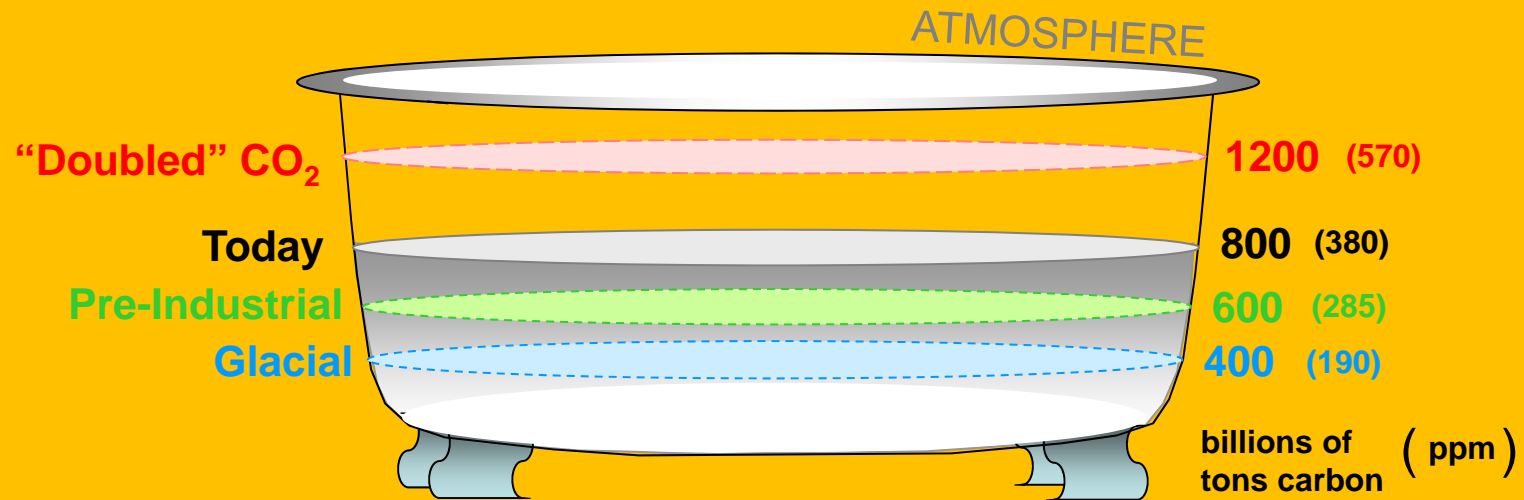
"Stabilization Wedges: Solving the Climate Problem for the next 50 Years with Current Technologies," S. Pacala and R. Socolow, *Science*, August 13, 2004

and presentation available at:
<http://cmi.princeton.edu/wedges/>

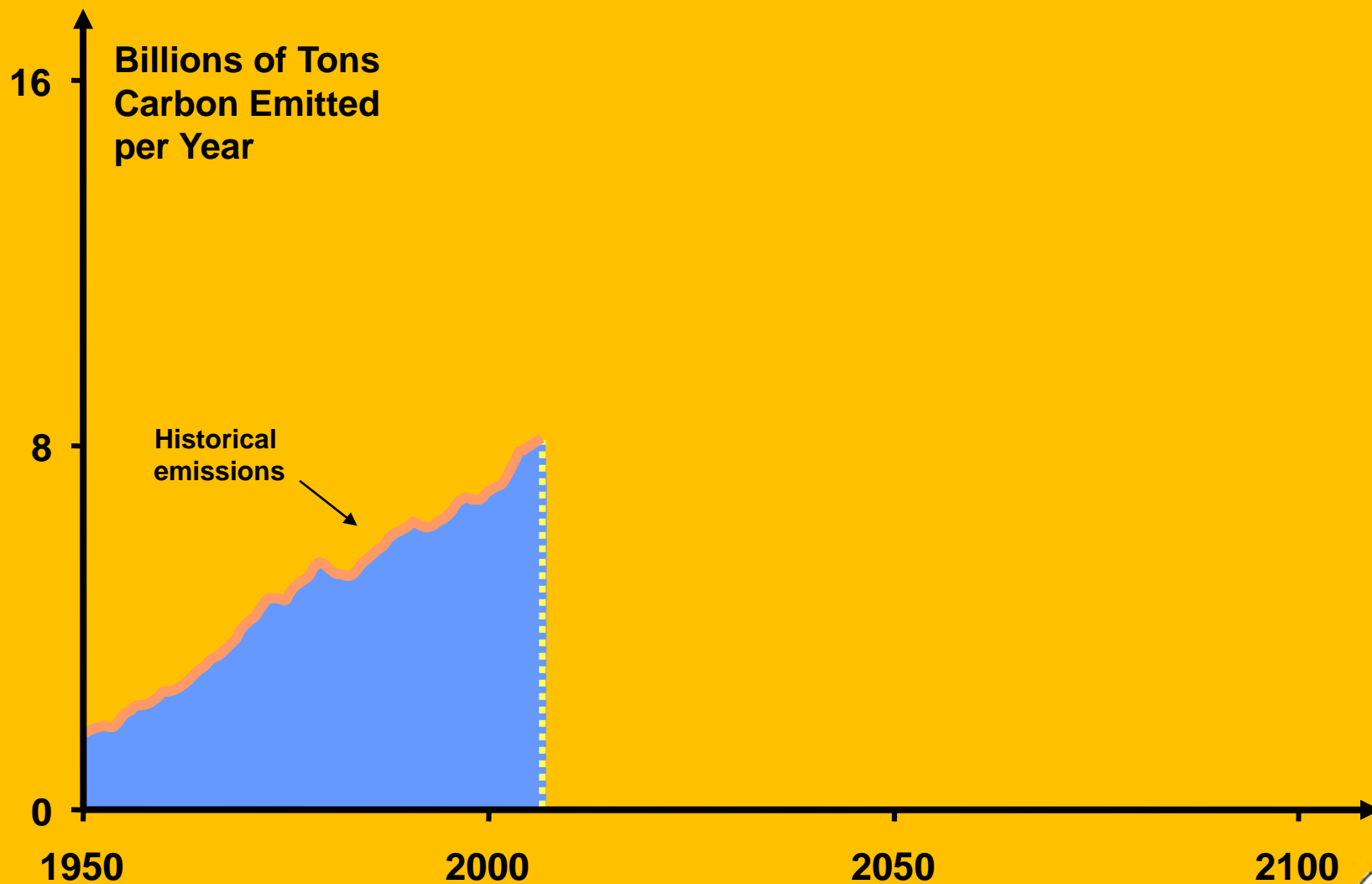




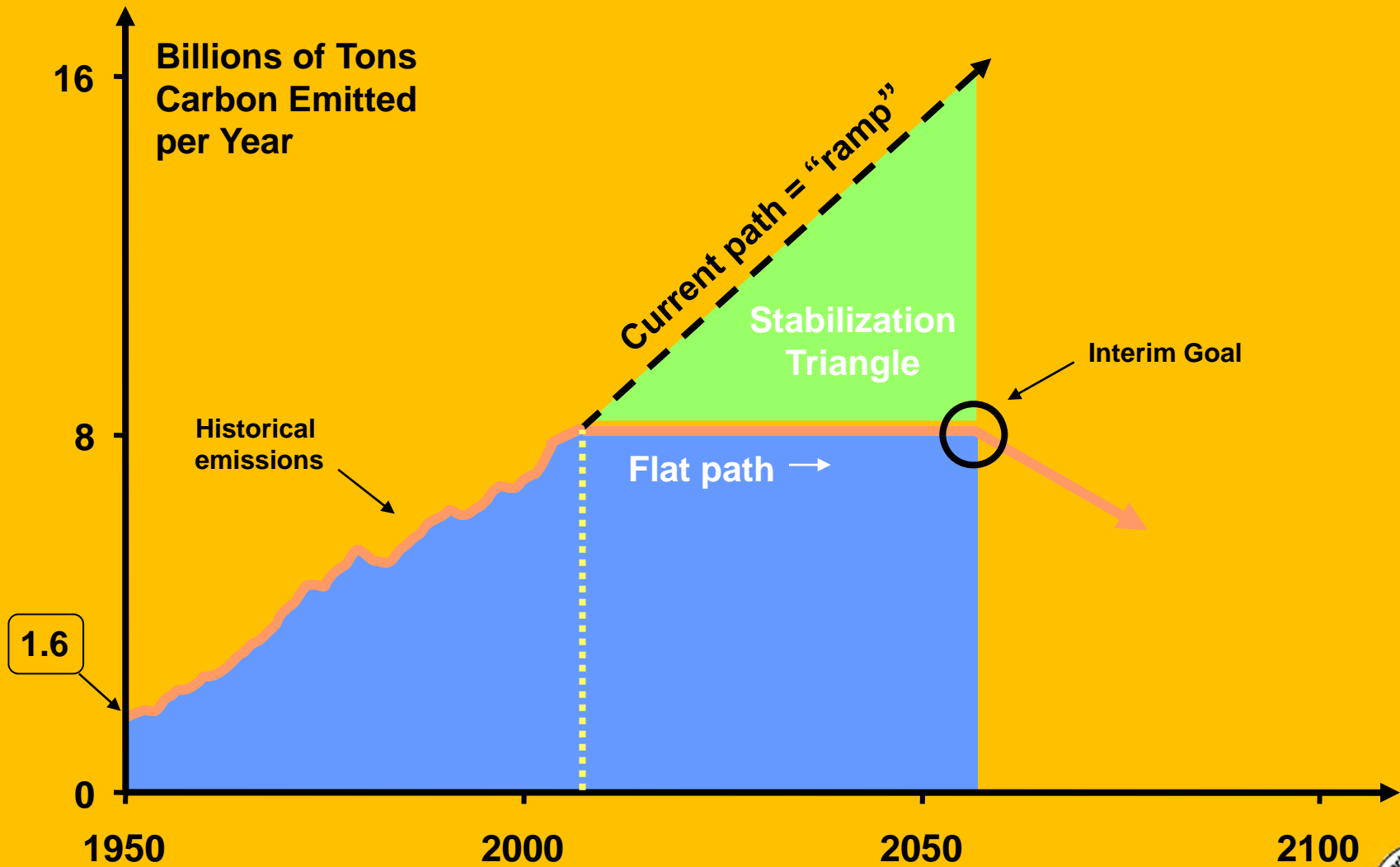
Past, Present, and Potential Future Carbon Levels in the Atmosphere



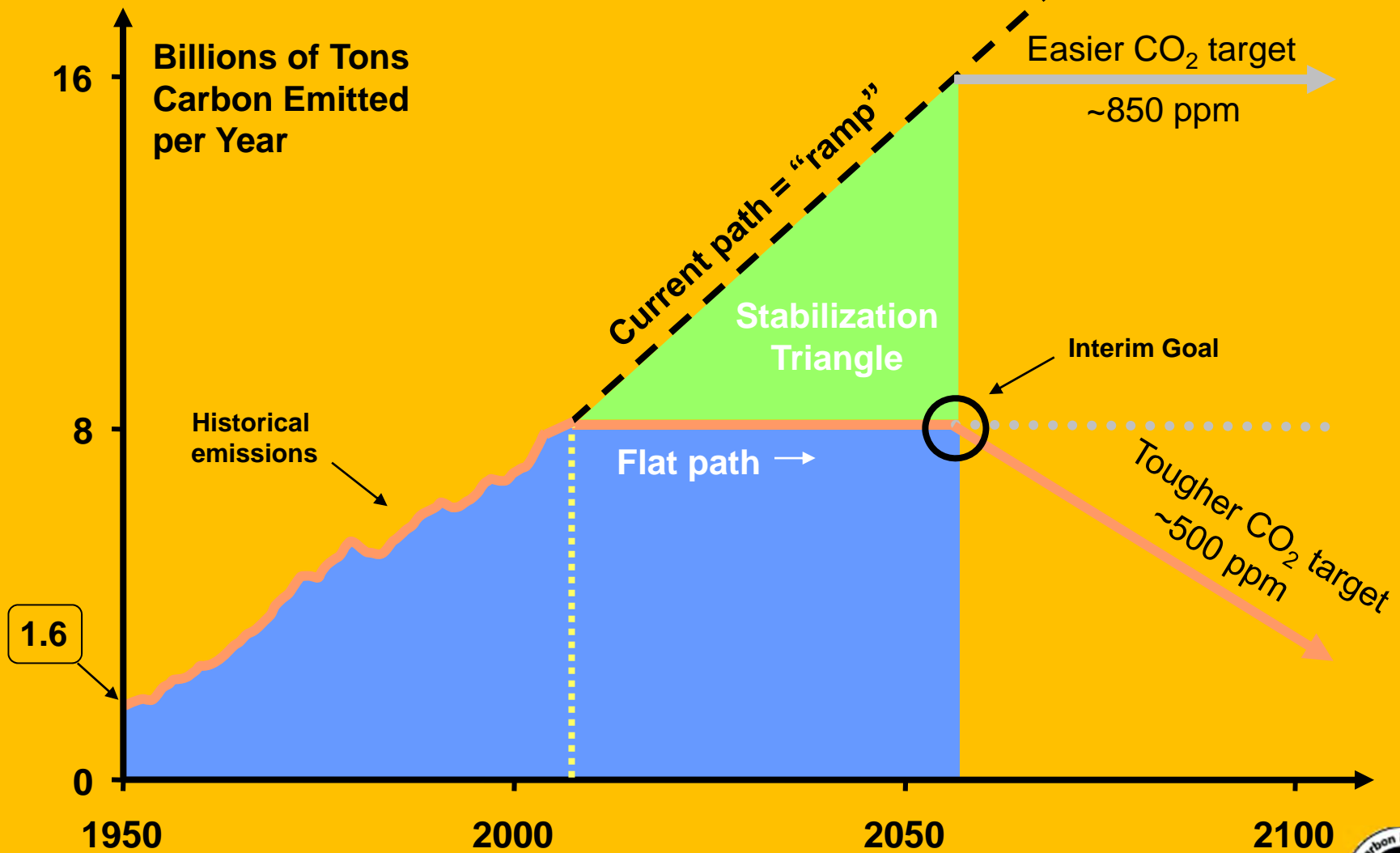
Historical Emissions



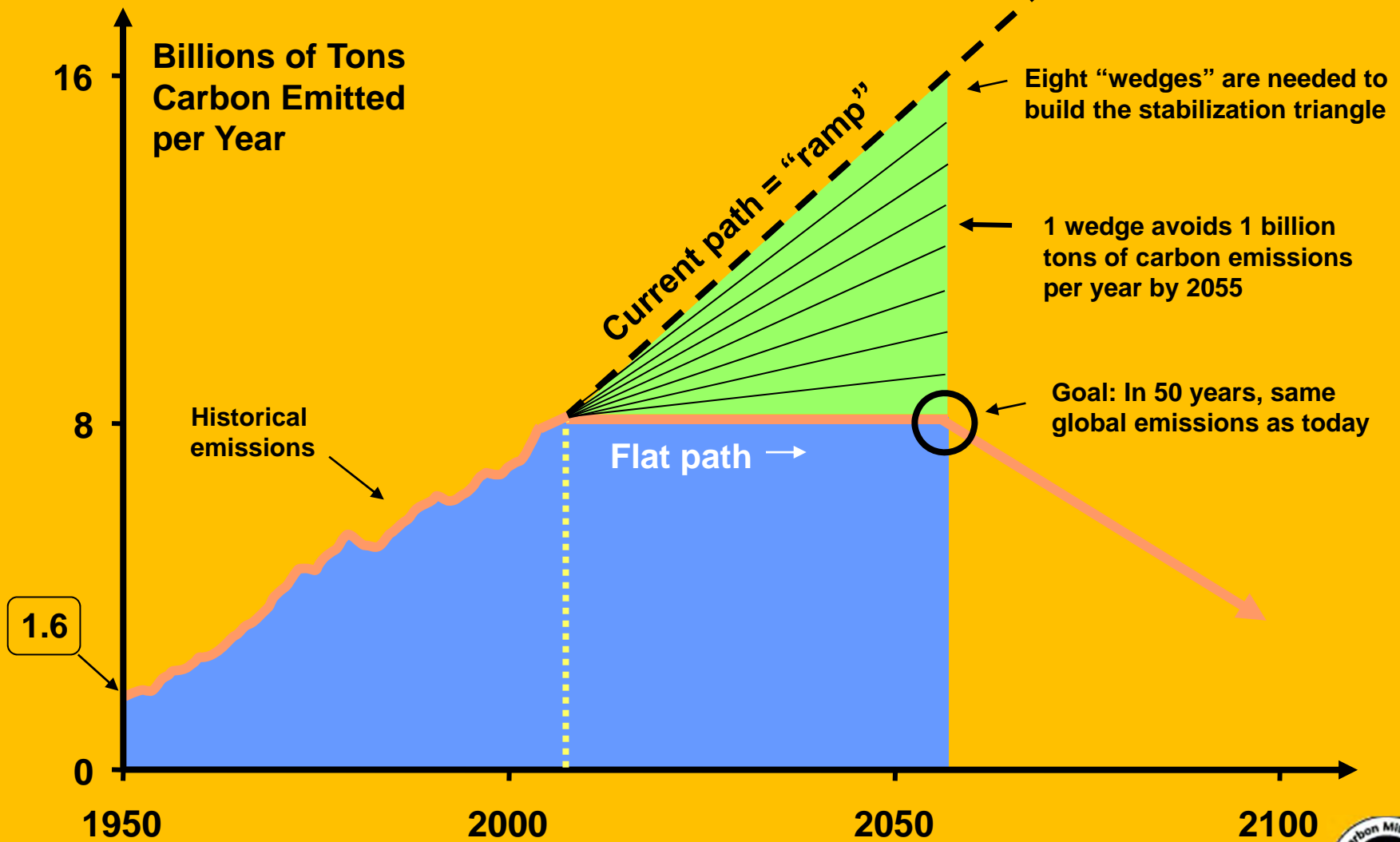
The Stabilization Triangle



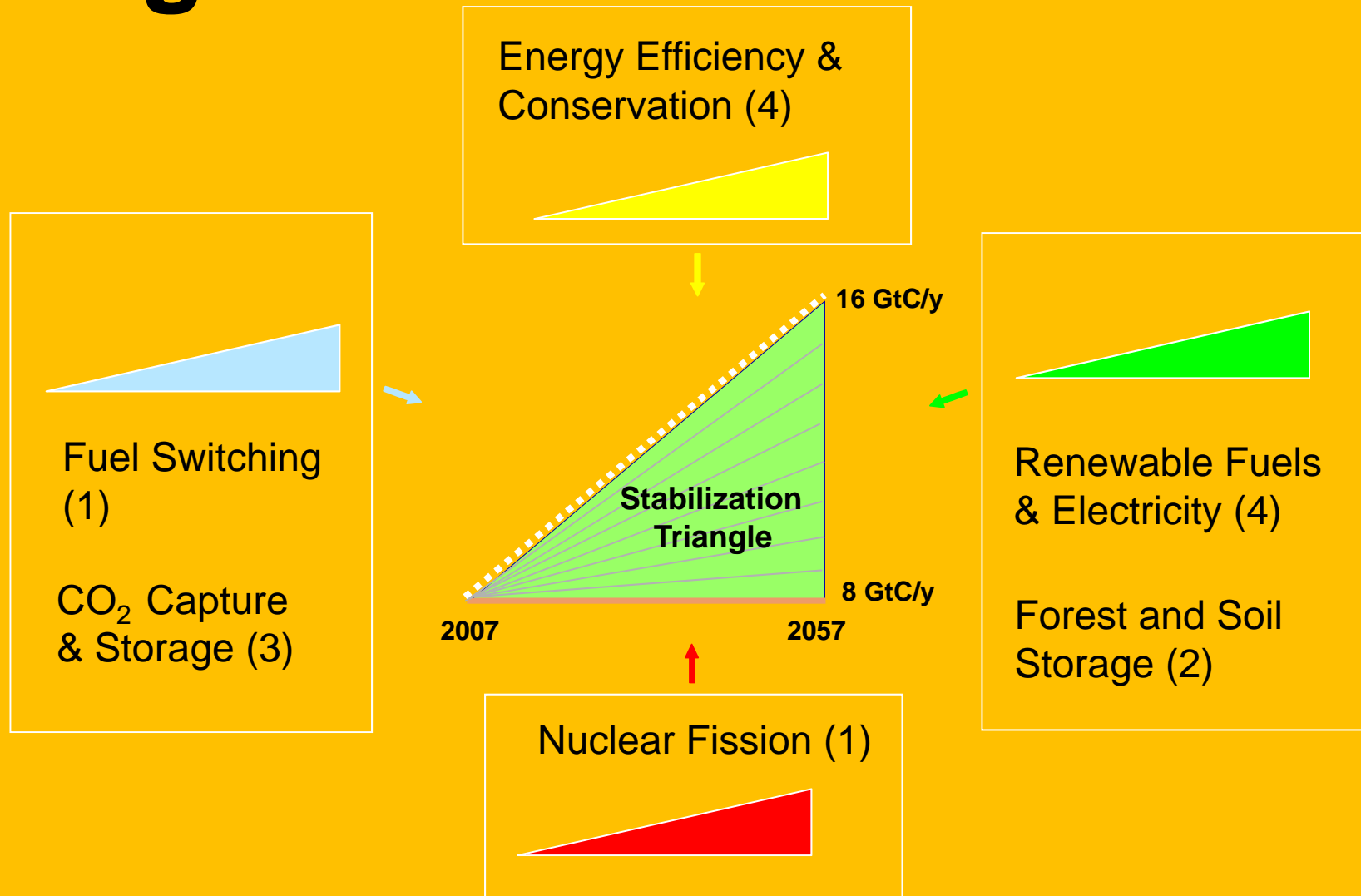
The Stabilization Triangle



Stabilization Wedges



15 Wedge Strategies in 4 Categories



Seven Ways to Reduce Carbon

[Seven Ways to Reduce Carbon](#)

<http://www.youtube.com/watch?v=-wcDHZ7Z-hQ>

Efficiency - Transport



**Double the fuel efficiency of
the world's cars**

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



\$

Conservation - Transport



Halve the miles traveled

\$

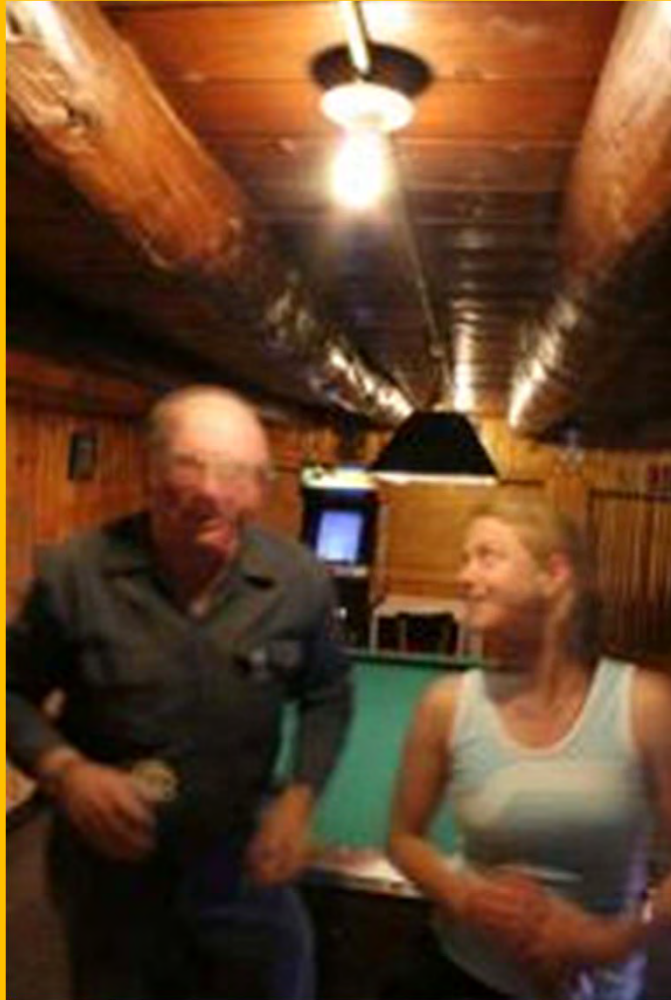
Efficiency - Buildings



Use best efficiency practices in all residential and commercial buildings

\$

Efficiency - Buildings



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

\$

Efficiency - Electricity



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

**Average coal
plant efficiency
is 32% today**

\$

Wind – Electricity



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

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

\$\$

Solar



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



Rooftop solar water and space heaters are good for the 1.6 billion people in the world without electricity

\$\$\$

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

\$\$

Forest Storage



Eliminate deforestation

Natural Sinks

\$

Forest Storage



Plant new forests

Natural Sinks

\$

Soil Storage



**Use conservation tillage
on *all* cropland**

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

Natural Sinks

\$

Nuclear Energy



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

\$\$

Fuel Switching



**Substitute natural gas electric plants for coal-fired facilities;
natural gas burns more efficiently and cleanly than coal**

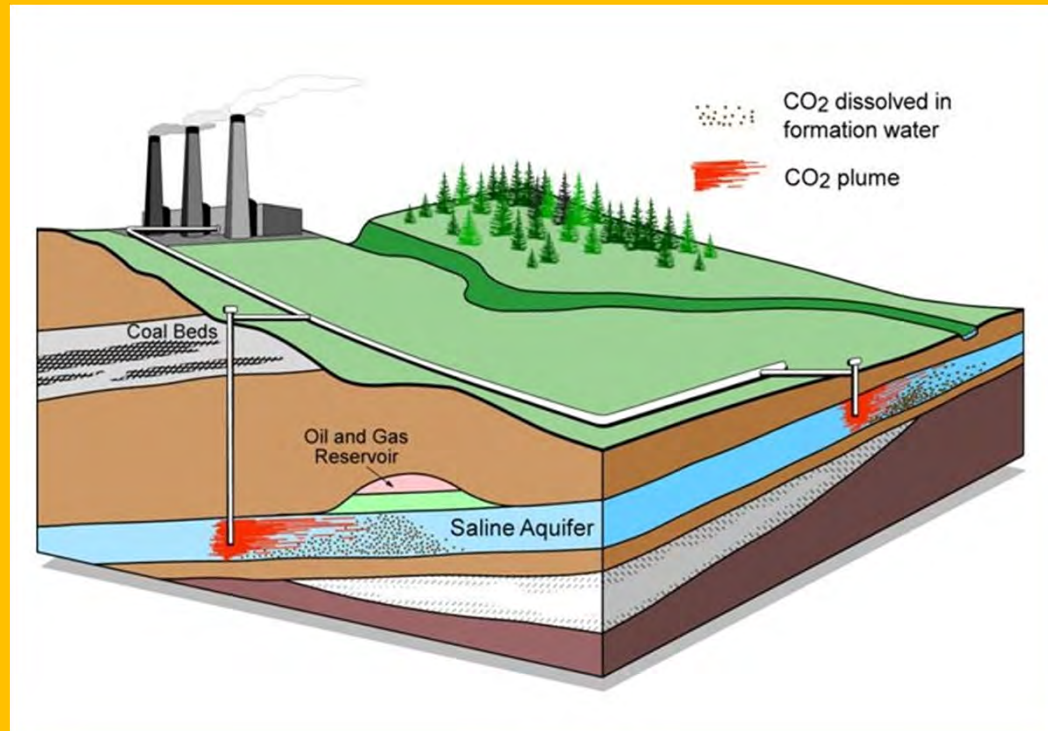
**Combined cycle generation plants with natural gas achieve 60%
efficiency**

\$

Carbon Capture & Storage

Implement CCS at

- 800 GW coal 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 CO₂ per year – by 2055 need 3500

White Roofs



White roofs reflect more sunlight and cool buildings

Take Home Messages

- In order to avoid a doubling of atmospheric CO₂, 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 CO₂ doubling
- Every “wedge” has associated impacts and costs



Climate Change Internship Opportunities

Spring Semester, 2011

Partnering organizations include:

- City of Missoula Conservation Lands Management
- Ecology Project International
- The UM Office of Sustainability
- UM ASUM Sustainability Center
- Climate Ride
- Missoula City Greenhouse Gas Advisory Committee
- The Sustainable Business Council
- US Forest Service Northern Region
- Aldo Leopold Research Institute
- Woody Biomass Utilization Program
- Clear Sky Climate Solutions
- The Clark Fork Coalition