



power generation group



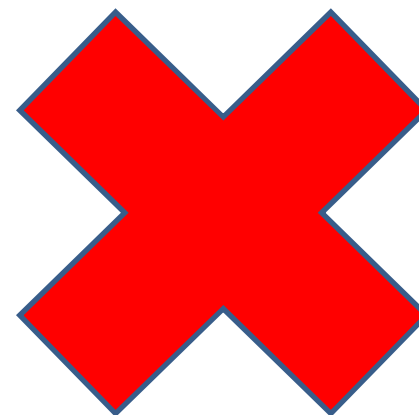
How I learned to **the Sierra Club**
and how we will be saved from climate
change

CIBO October 18, 2013

Tim Hicks

Warning

- **This presentation may contain graphs and charts that some people may find offensive.**
- **The opinions expressed are solely those of someone, and may not reflect the opinions of CIBO, Me, B&W, or the industry in general.**



Muir Glacier, Alaska

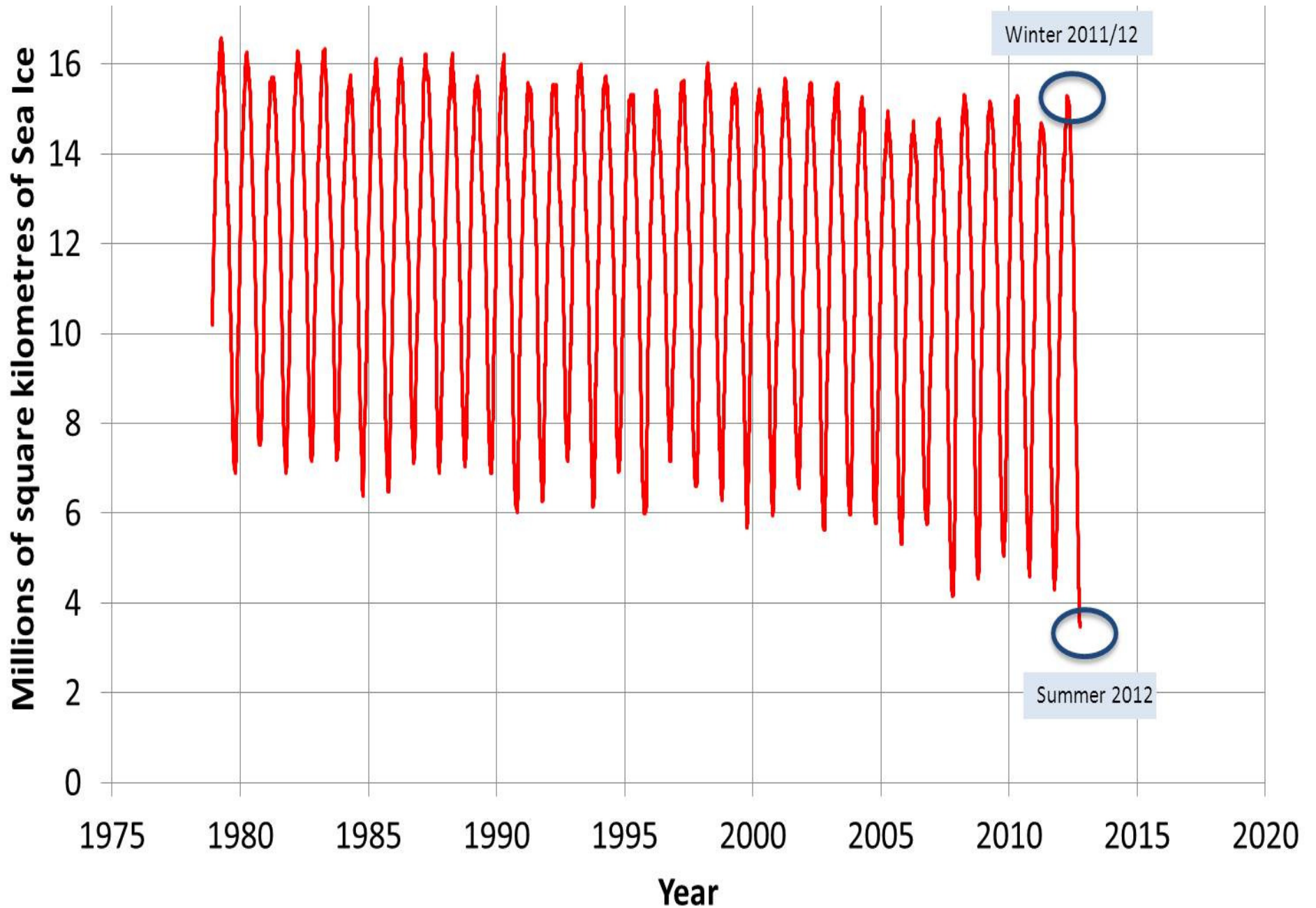
**Glaciers are
retreating:
*worldwide***



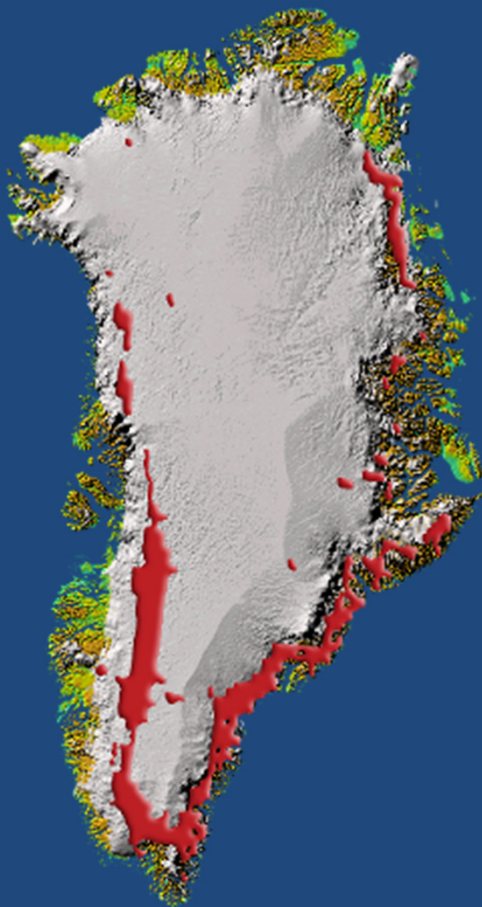
Photo credit:
Global Warming Art

Arctic Sea Ice

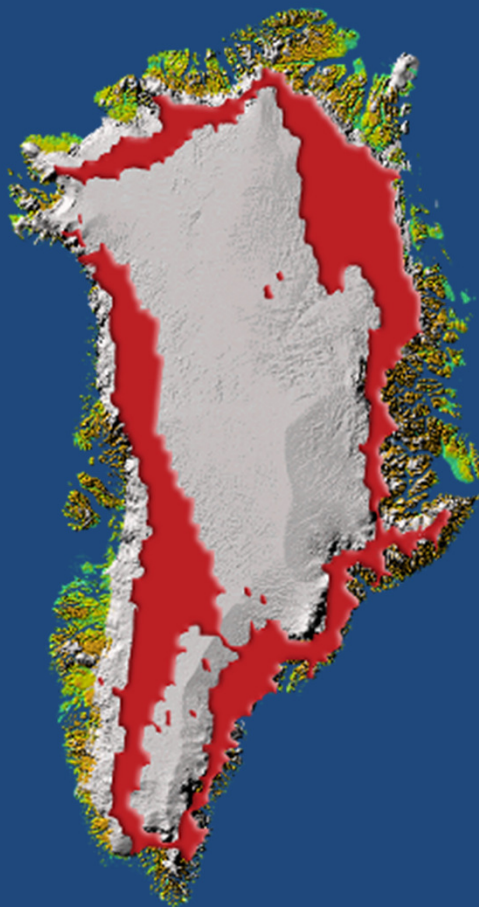
<http://nsidc.org/arcticseaicenews/>



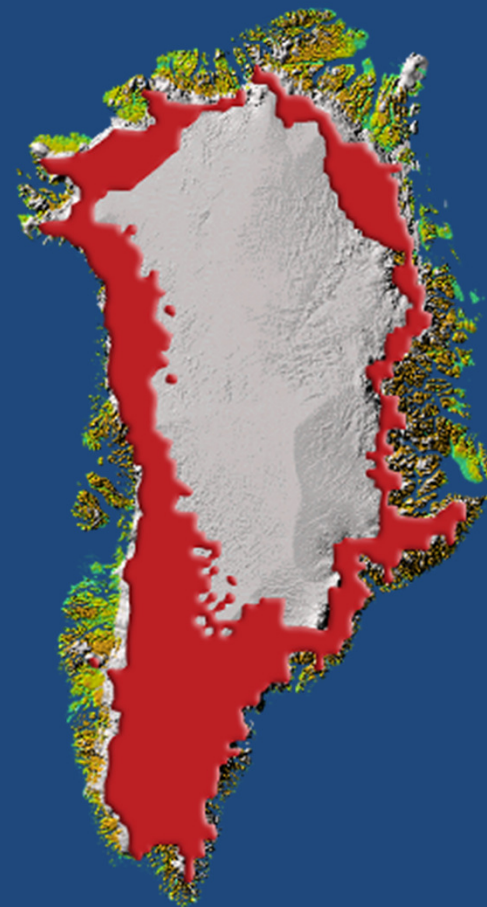
Greenland Seasonal Ice Melt



1992

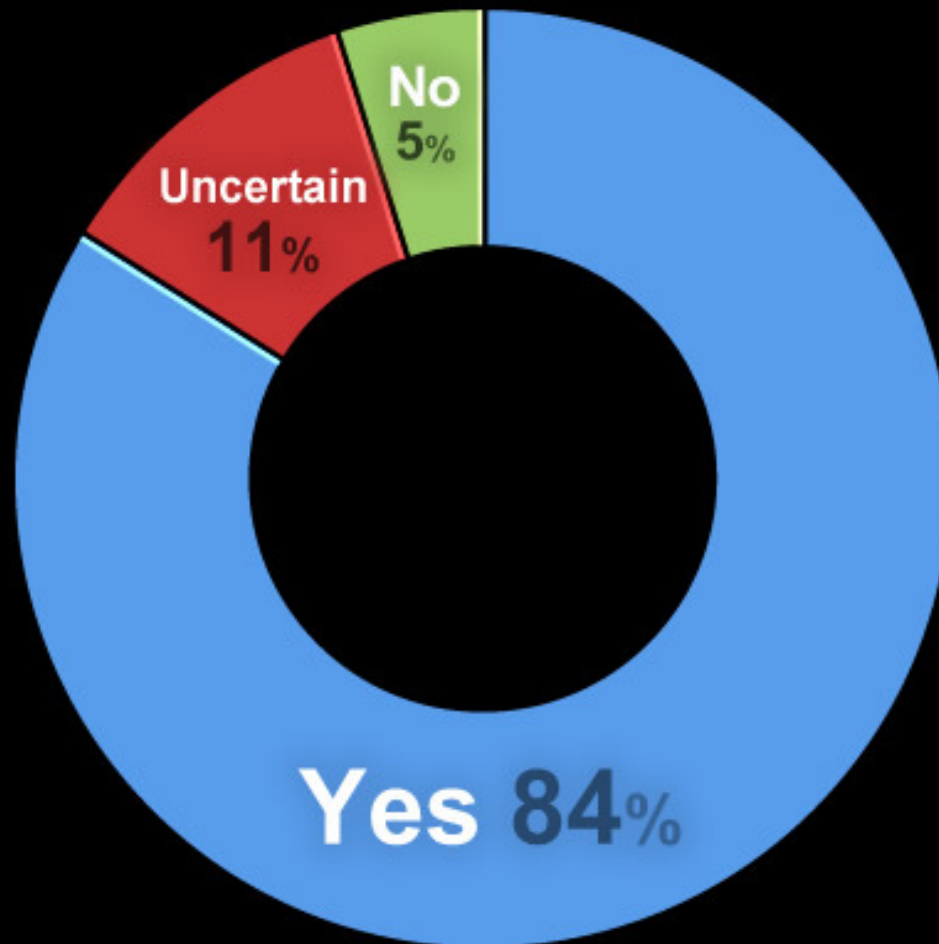


2002



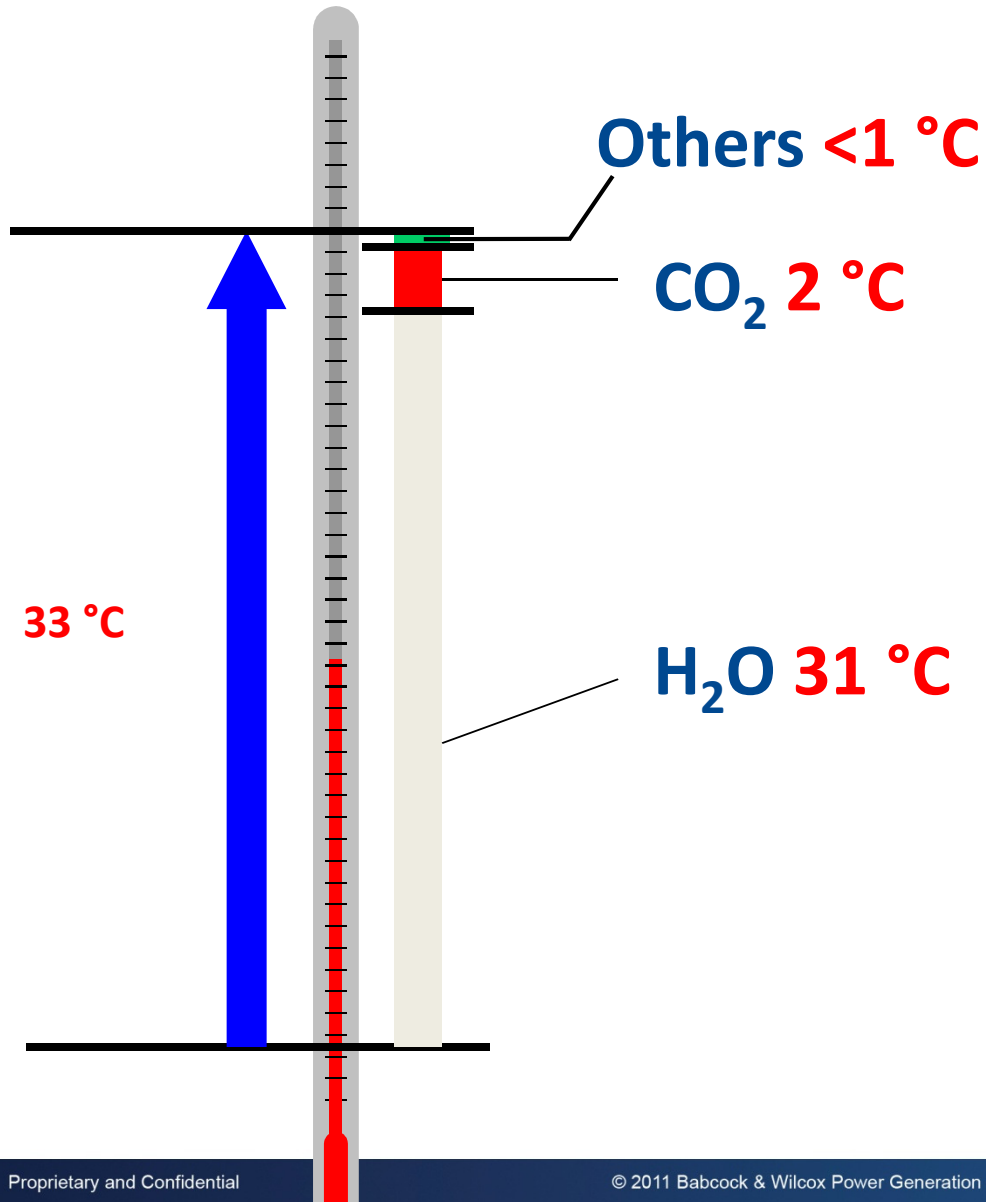
2005

Climate Scientists: Are humans responsible for observed warming?



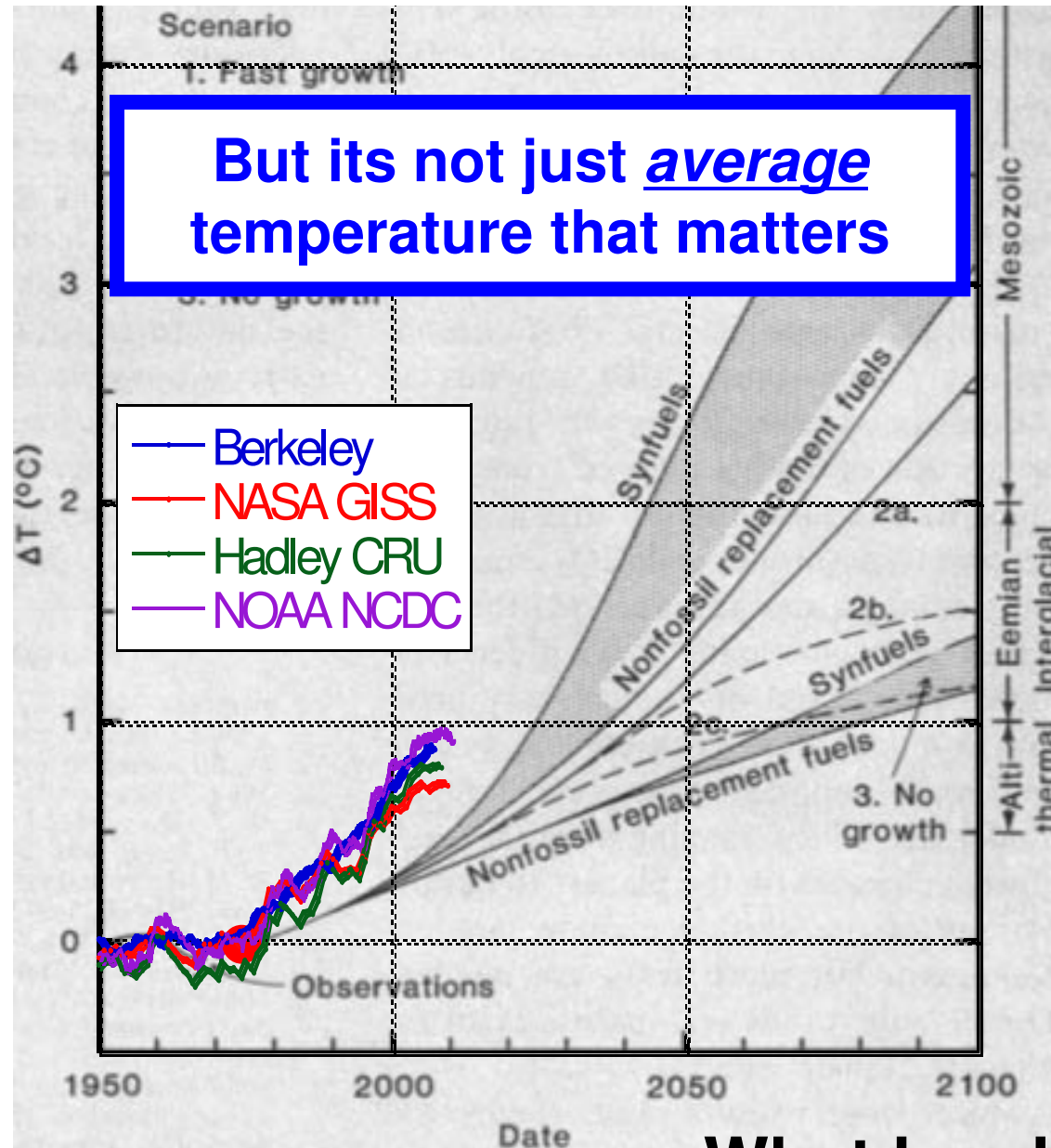
The COMET Program / Statistical Assessment Service at George Mason University

Greenhouse Warming



If H₂O is a more important greenhouse gas than CO₂, why aren't we worried about water vapour emissions?

What did Global Warming Theory predict in 1981?



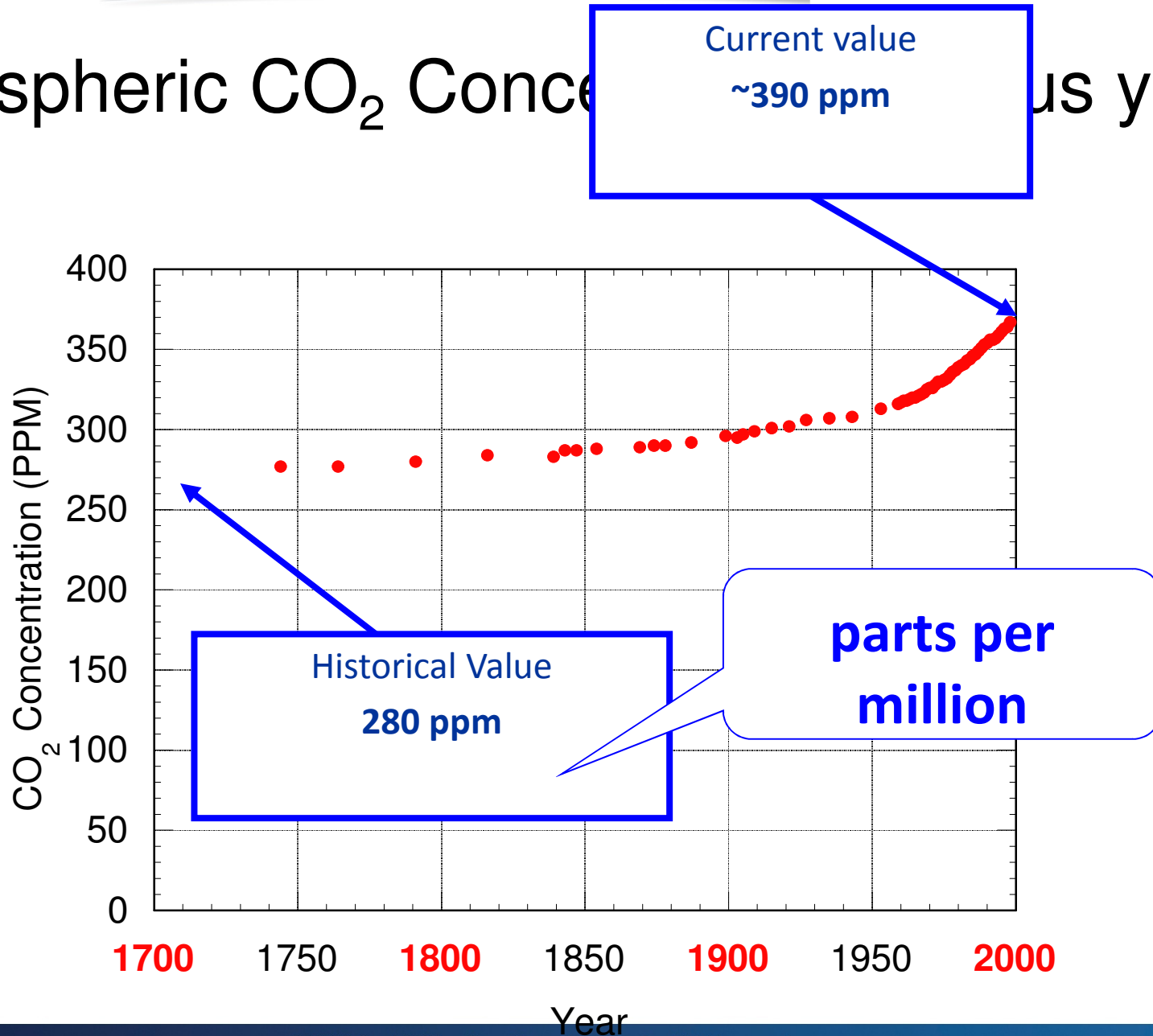
<http://berkeleyearth.org>

Proprietary and Confidential

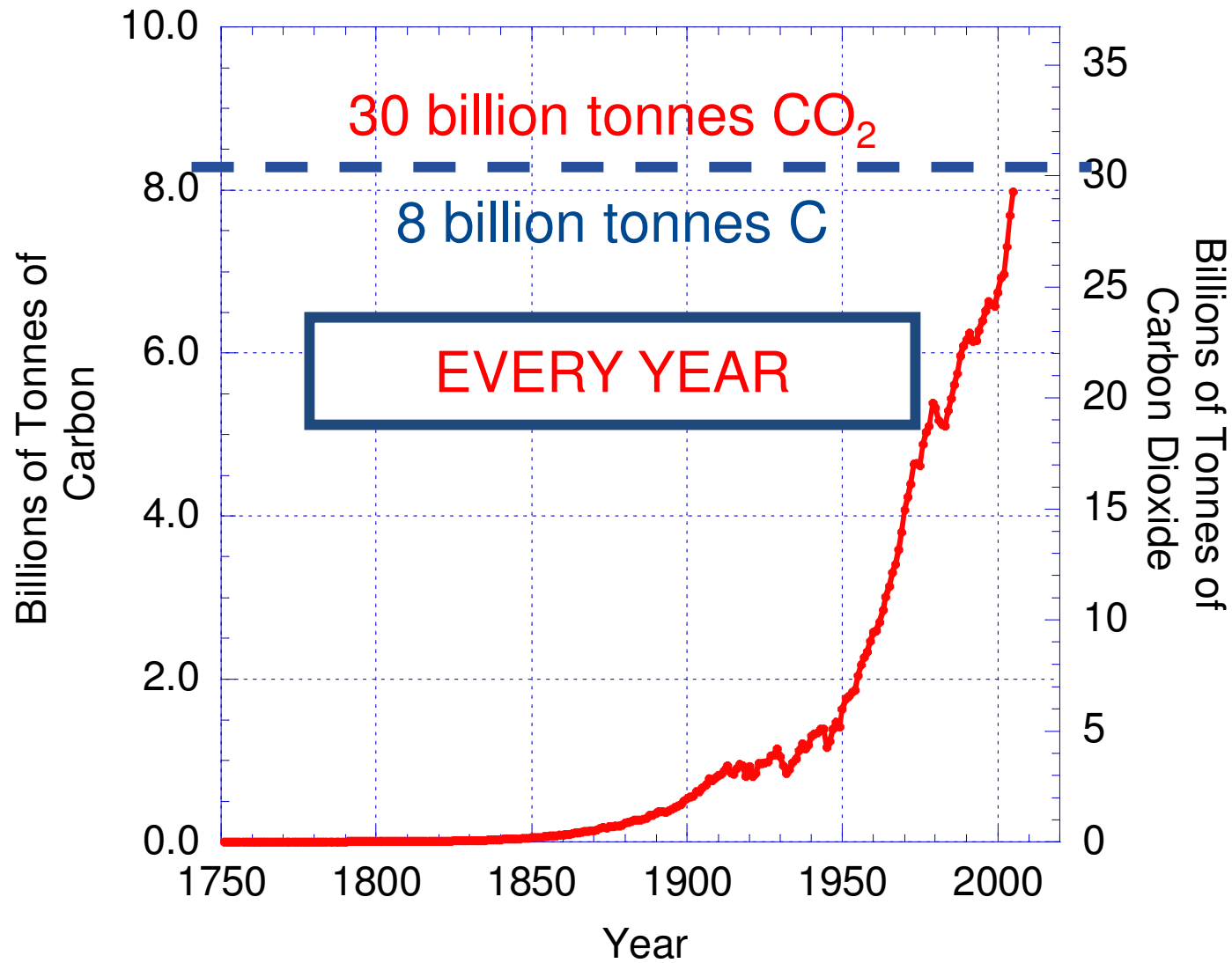
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What has happened?

Atmospheric CO₂ Concentration over the last 200 years

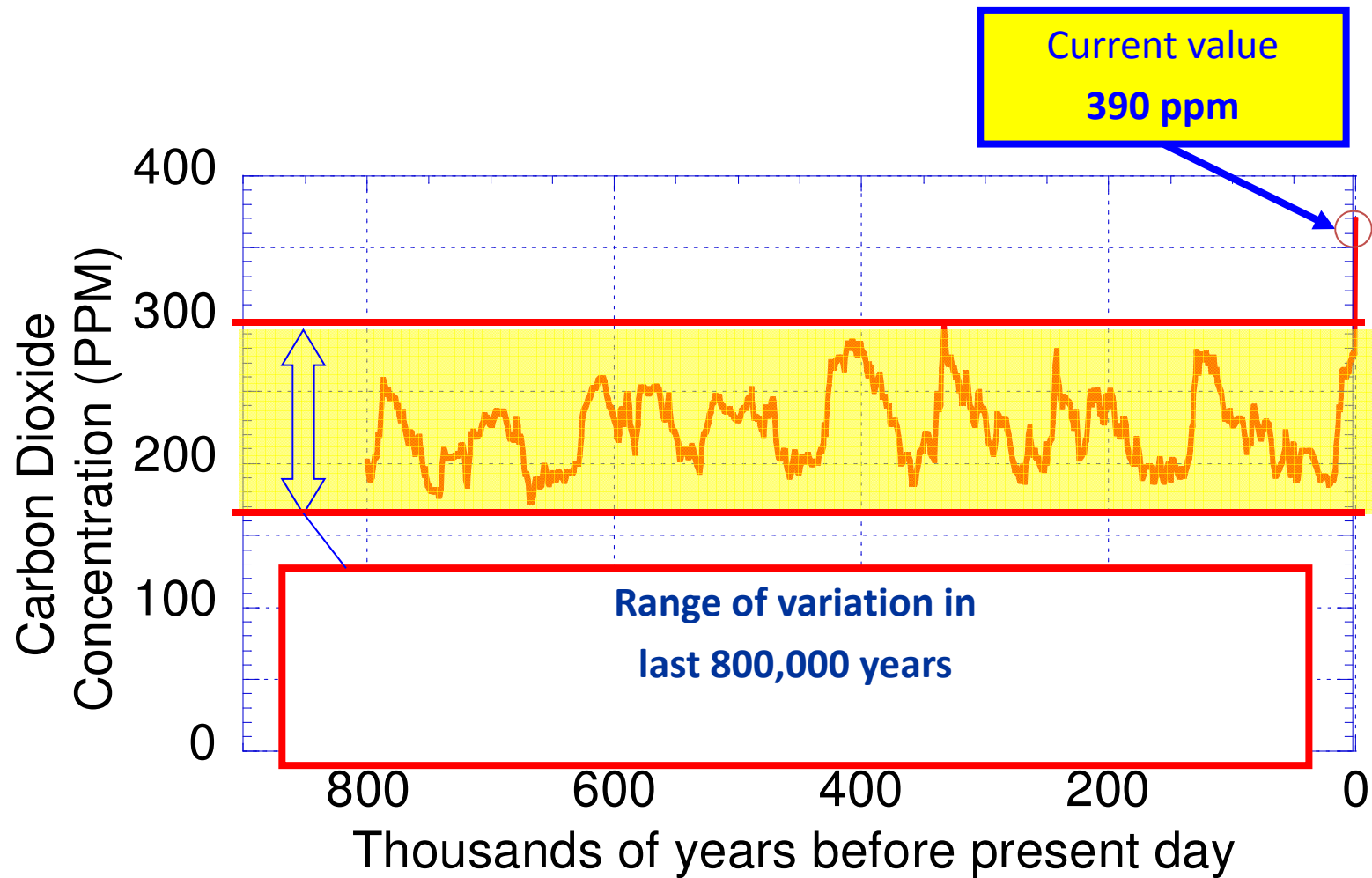


Global CO₂ Emissions

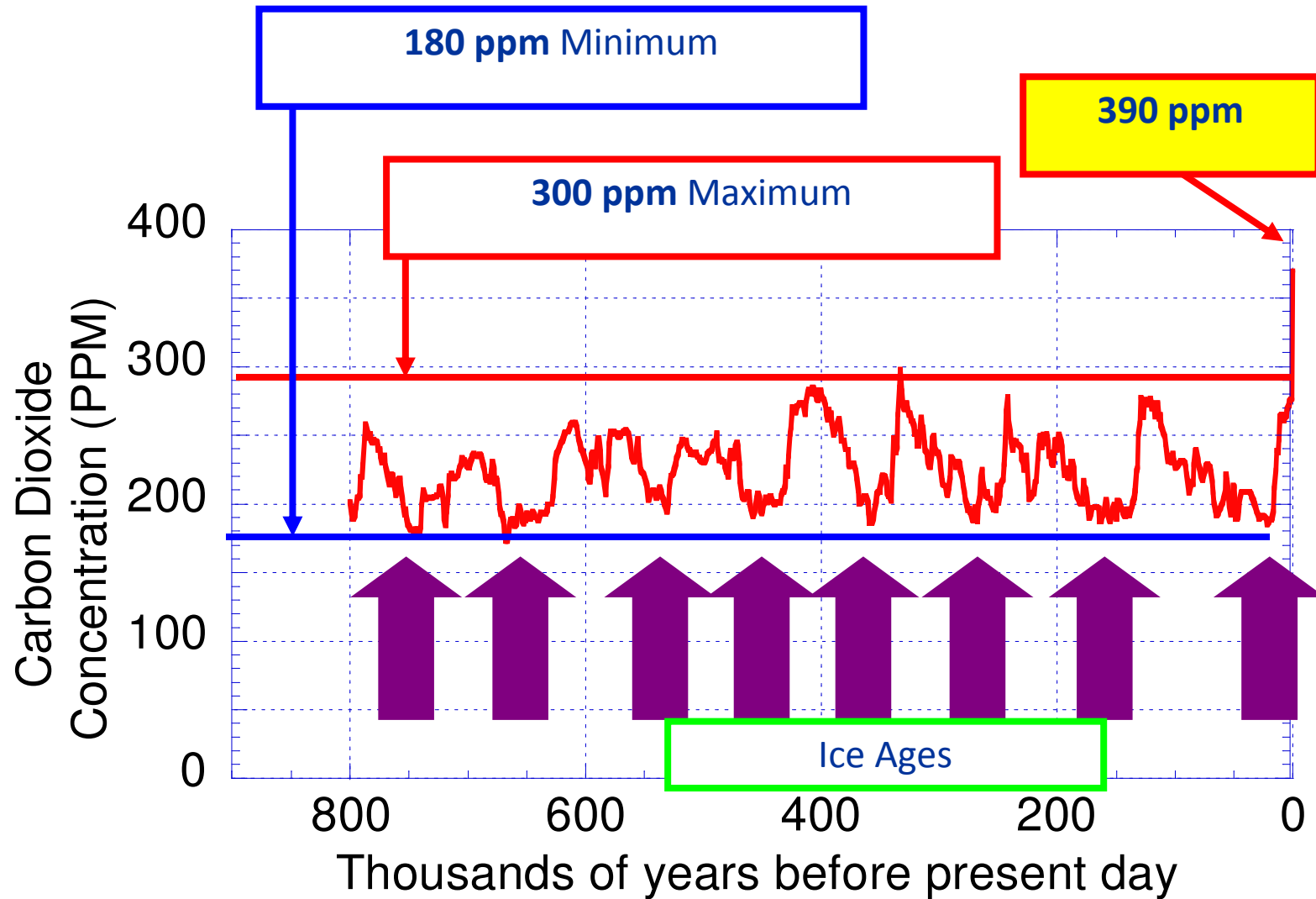


Pre-Historic studies

Bubbles in Arctic *and* Antarctic Ice



Bubbles in Arctic *and* Antarctic Ice



IPCC Predictions...

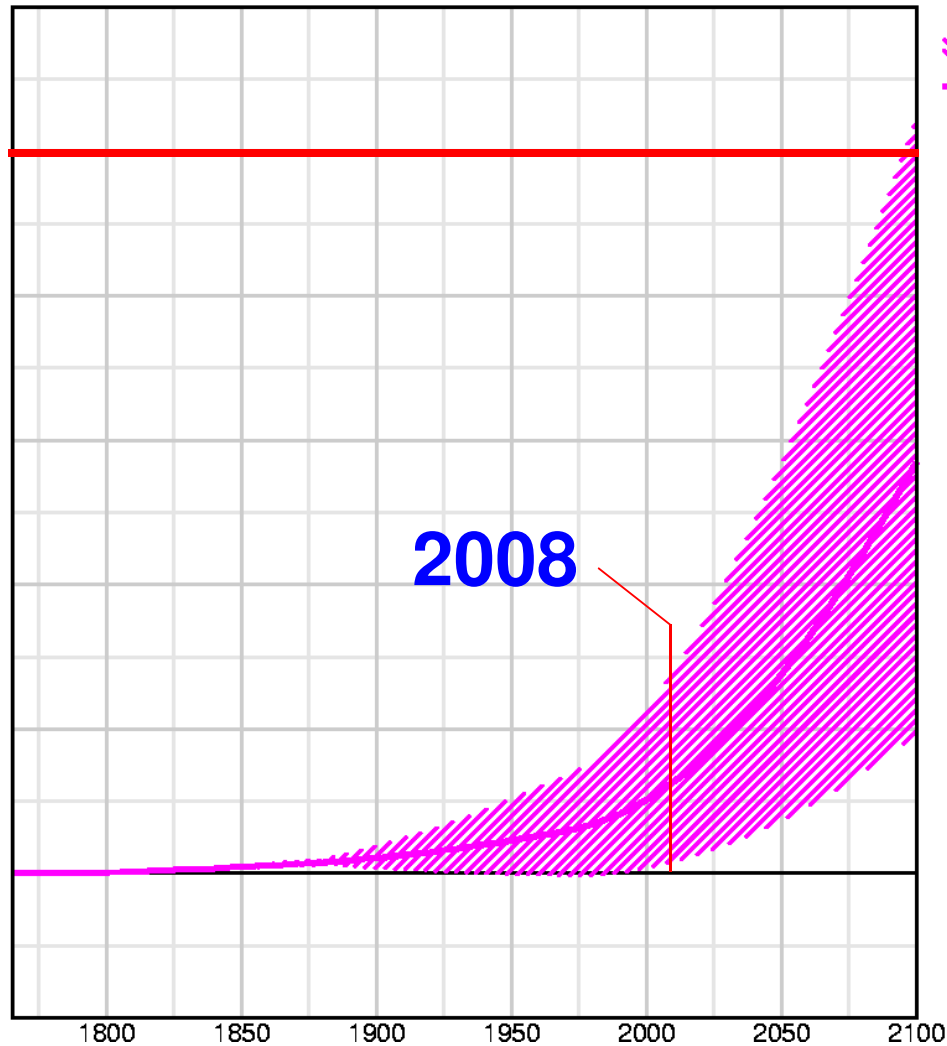
Climate Research Unit East Anglia University

Sea Level Change (cm) w.r.t. 1765

Reference: IPCC emissions scenario 92a

Policy: IPCC emissions scenario 92a

1 metre



Reference Range
Reference Best Guess

0.5 metres in
100 years ?

Scientific American™

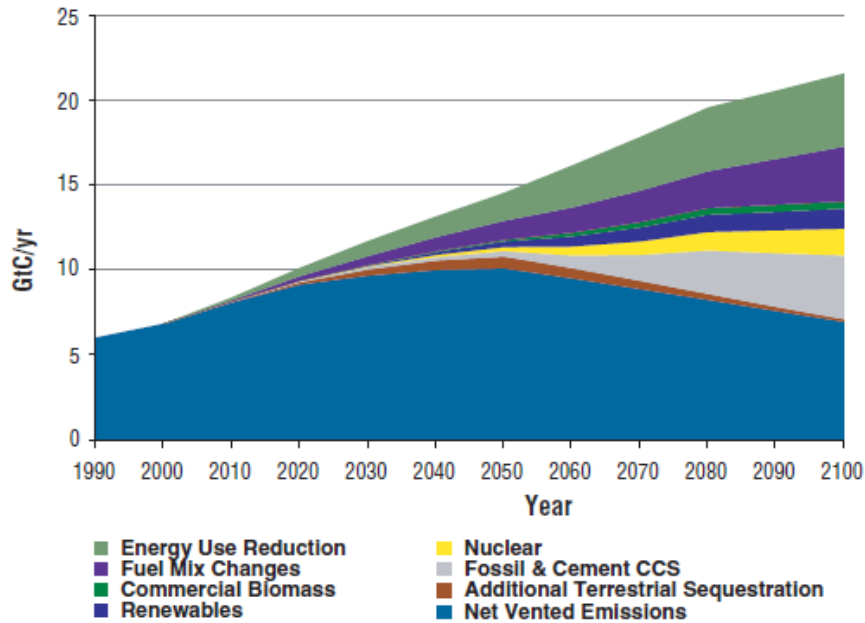
10 Solutions for Climate Change

Ten possibilities for staving off catastrophic climate change

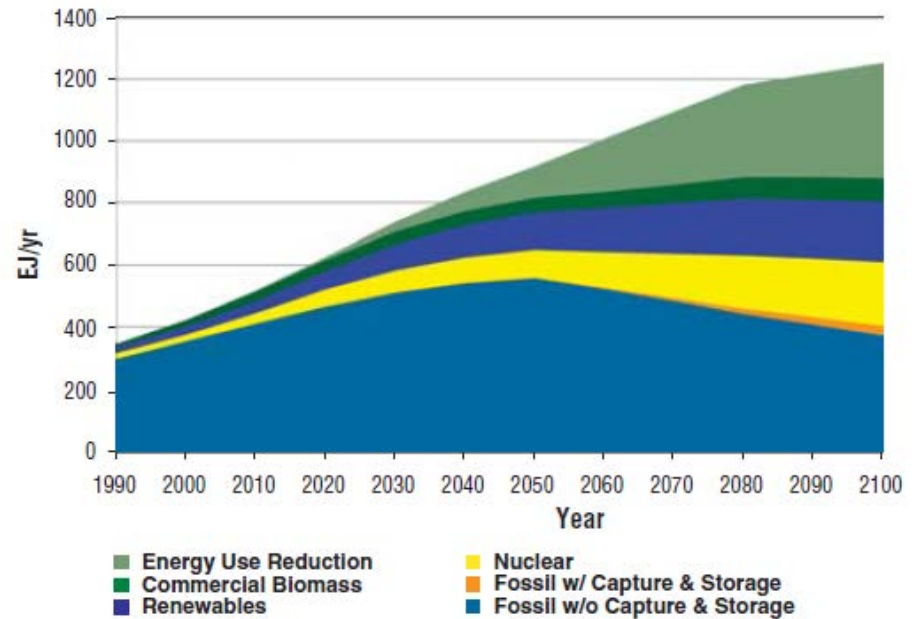
Eat Smart, Go Vegetarian?—Corn grown in the U.S. requires barrels of oil for the fertilizer to grow it and the diesel fuel to harvest and transport it. Some grocery stores stock organic produce that do not require such fertilizers, but it is often shipped from halfway across the globe. And meat, whether beef, chicken or pork, requires pounds of feed to produce a pound of protein.

“US Climate Change Strategic Plan”

SCENARIO 1

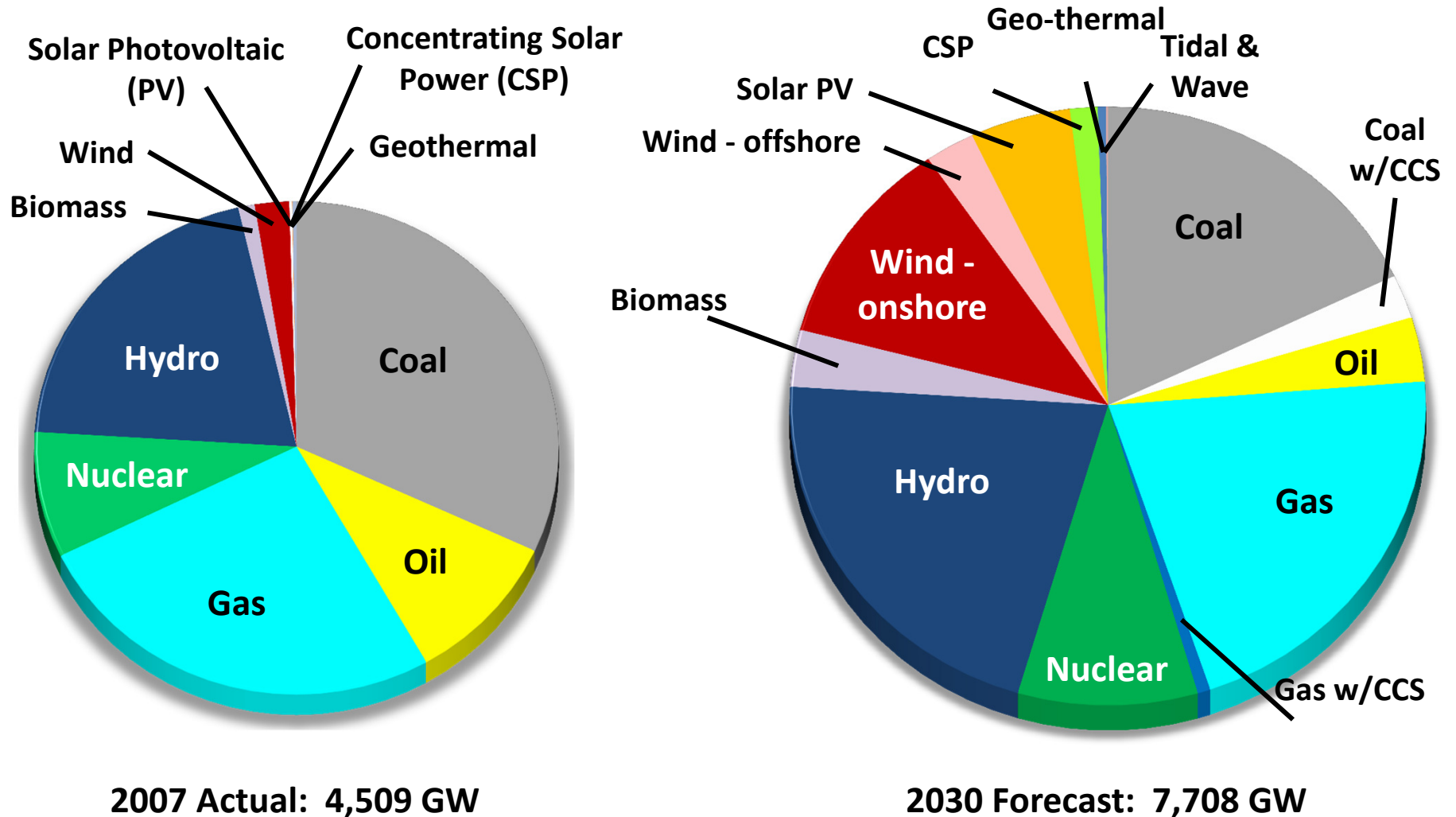


SCENARIO 2



Future Requires All Energy Sources

Worldwide Installed Electric Generating Capacity by Fuel, 2007 and 2030

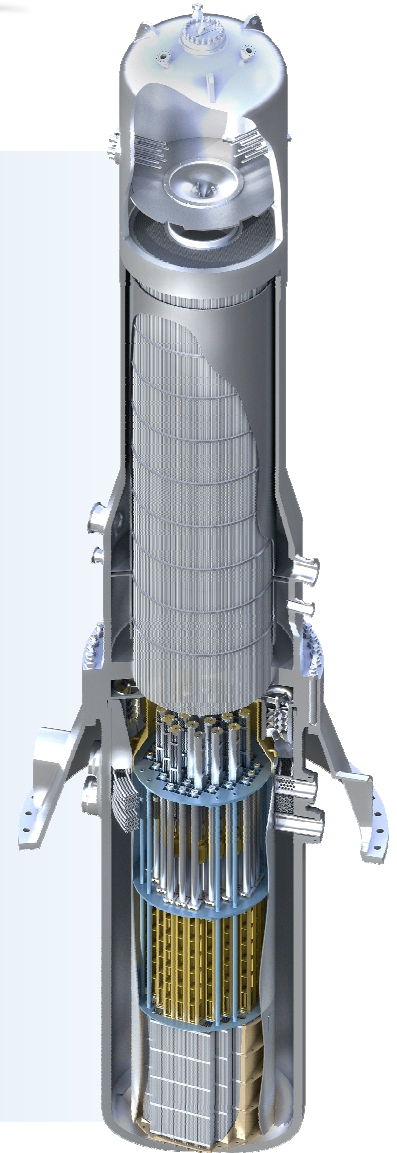


Source: International Energy Agency, *World Energy Outlook 2009*, Scenario 450

B&W mPower™ Modular Nuclear Reactor

B&W's Generation III++ Reactor

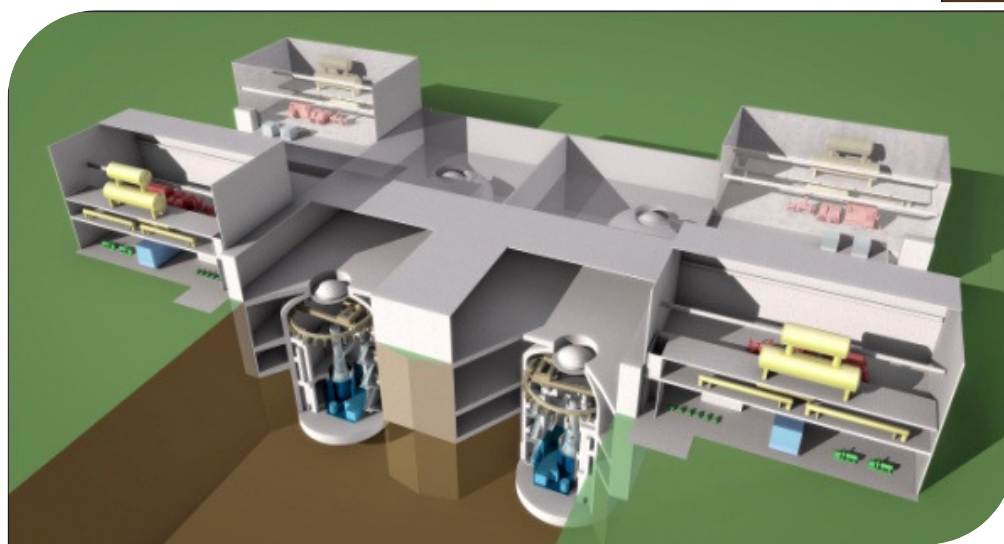
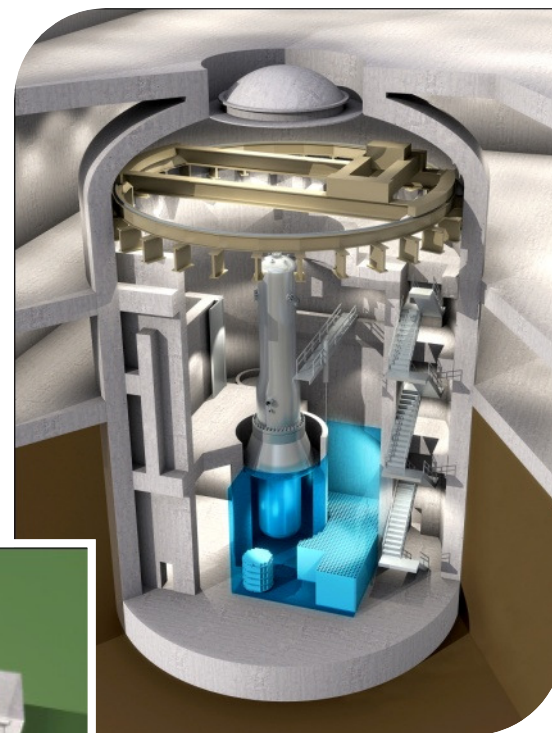
- Integral 125 MW_e modular reactor
- Proven Advanced Light Water Reactor (LWR) technology
- Simple, passively safe design
- Utilizes “industry standard” Pressurized Water Reactor (PWR) fuel
- No active core cooling systems
- Passive decay heat removal



B&W mPower™ Modular Nuclear Reactor

B&W's Generation III++ Reactor

- Built in North America, in B&W factories
- Dry containment – no suppression pool
- No emergency AC power – batteries only
- Reactor installed after construction
- Spent fuel storage for 60-year plant life



TVA Clinch River Project

Construction Work Contracted:

- ▶ Geological Surveys (site borings)
- ▶ Environmental Reviews
- ▶ Site-specific Conceptual Designs
- ▶ Preliminary Safety Evaluation (PSAR)

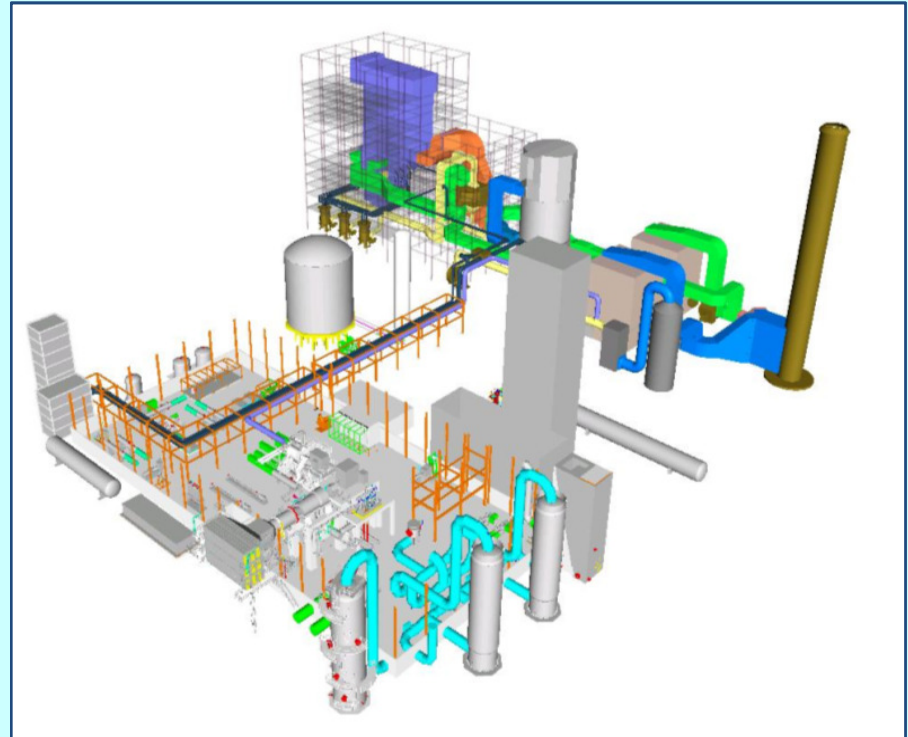


mPower America Project:

- ✓ **Construction Permitting started 2013**
- ▶ Manufacturing start target 2015
- ▶ Construction start target 2017
- ▶ Reactor Modules ready by 2019
- ▶ Commercial Operation (COD) by 2022

Oxy Combustion Carbon Capture Technology

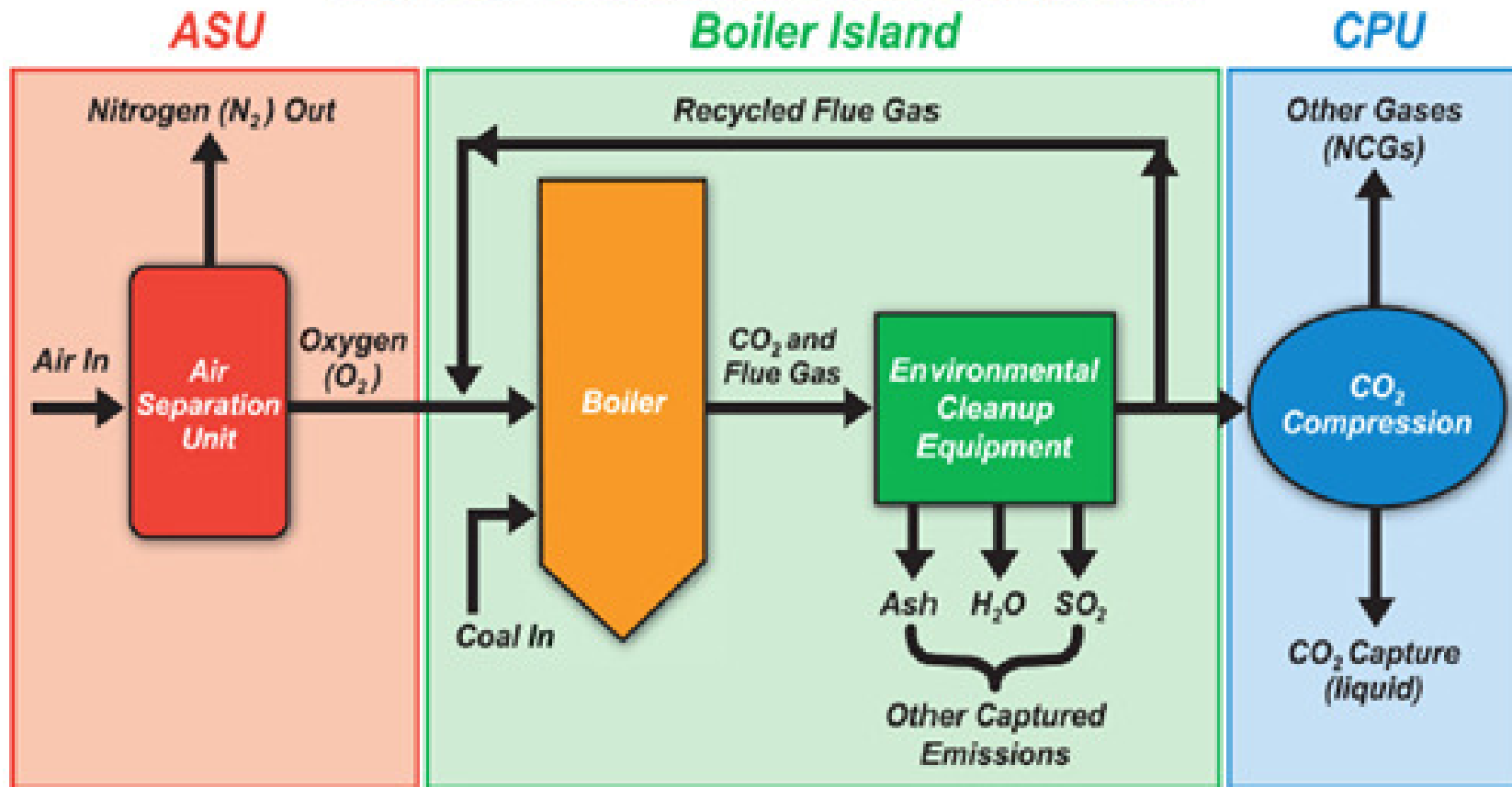
- Near zero emissions and greater than 90% CO₂ capture
- Coal-fired combustion system with pure oxygen and recycled CO₂
- Reference plant designs being completed for 300 MW_e and 550 MW_e
- Ready now to demonstrate at commercial scale



Reference Plant Design

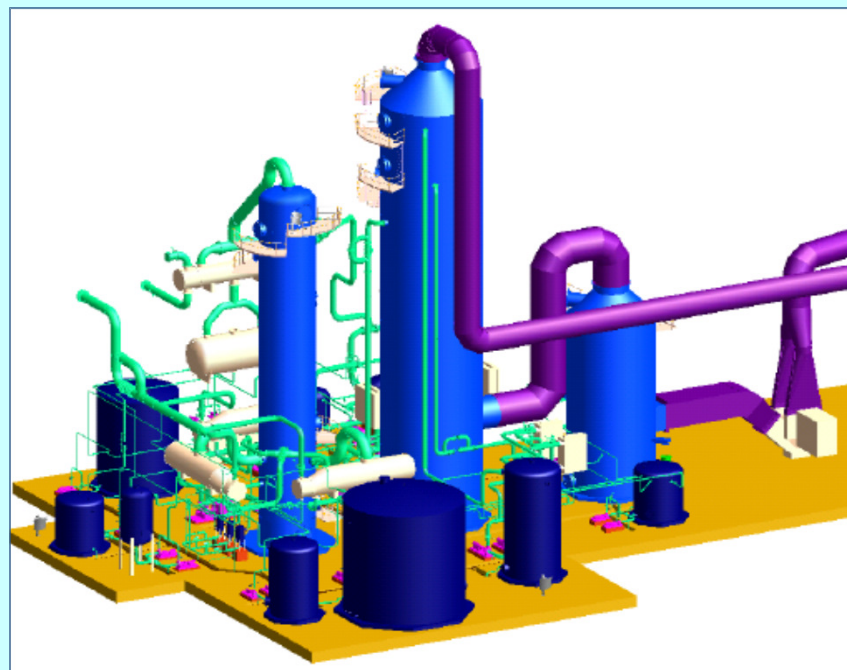


Oxy-Coal Combustion Plant Configuration



RSAT™ Post Combustion CO₂ Capture Technology

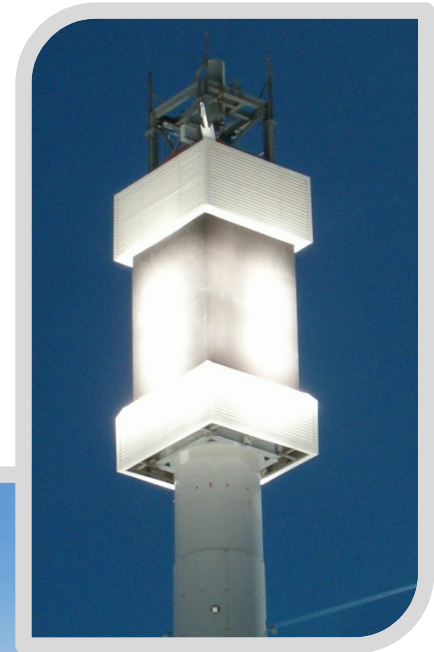
- **Regenerable Solvent Absorption Technology (RSAT™)**
- **Up to 90% CO₂ capture**
- **Advanced solvent-based scrubber**
- **Applications: new or retrofit; coal, oil, natural gas**
- **RSAT CO₂ scrubber facility operating at B&W R&D center**
- **Ready now for near commercial scale field demonstration**



Field demo up to 1500 TPD (75 MW)

Solar

- **Steam flow: 31,000 lbs/hr**
- **Typical output: ~2.6 MWe**
- **Tower height with receiver: less than 200 ft**
- **Approximate weight: less than 100,000 lbs (dry)**



Biomass

- **Dispatchable, renewable, commercial technology for industrial units**
- **A viable component of near-term RPS/RES utility compliance**
- **Diverse fuel sources drive technology selection for new and retrofit scenarios:**
 - **Circulating Fluidized Bed (CFB)**
 - **Bubbling Fluidized Bed (BFB)**
 - **Stoker**
 - **Gasifier**
 - **Suspension Firing**
 - **Co-Firing**



Embrace the new carbon constrained economy

“If you cant be part of the solution, its nice to know there is money to be made being part of the problem” Despair.com

