OVERVIEW OF CLIMATE CHANGE SCIENCE AND POLICIES

Presentation to

Louisiana Public Service Commission

By
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LSU Center for Energy Studies

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OVERVIEW OF CLIMATE CHANGE SCIENCE AND POLICIES

PRESENTATION OUTLINE

Introduction/Background

Session 1

- **Current Status of Climate Science**
- **Status of International Policies**
- **References/Suggested Reading**
- **Questions/Discussion**

----------Break----------

Session 2

- **Federal & State Policies**
- **Mitigation Technologies**
- **Questions/Discussion**

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STIPULATIONS, DEFINITIONS, AND OBSERVATIONS

- Full disclosure
- Global warming → Climate change → Climate disruption
- AGW – anthropogenic (man-made) global warming
- Climate is not static, it is always changing
- Weather ain't climate
- The science is far from settled
- The lamestream media "if you don't read the paper you're uninformed, if you read the paper you're misinformed"
- "Warmer" versus "skeptic" or "denier"
- UNIPCC – United Nations Intergovernmental Panel on Climate Change
- NIPCC – Nongovernmental International Panel on Climate Change
- The "perfect bandwagon"
- The "hockey stick graph"
- The "gates" – climategate, amazonegate, africagate

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SELECTED NOTABLE “SKEPTICS”

Freeman John Dyson, an English-born American physicist, mathematician, and futurist, famous for his work in quantum mechanics, nuclear weapons design and policy, and the search for extraterrestrial intelligence.
Patrick Moore, founder of GreenPeace and nationally recognized environmentalist.
William Happer, Cyrus Fogg Brackett Professor of Physics, Princeton University, Fellow APS, AAAS, Member National Academy of Sciences.
William M."Bill" Gray, Emeritus Professor of Atmospheric Science at Colorado State University (CSU), and head of the Tropical Meteorology Project at CSU's Department of Atmospheric Sciences. He is a pioneer in the science of forecasting hurricanes and one of the world's leading experts on tropical storms.
Roy W. Spencer is a climatologist and a Principal Research Scientist for the University of Alabama in Huntsville, as well as the U.S. Science Team Leader for the Advanced Microwave Scanning Radiometer(AMSR-E) on NASA’s Aqua satellite. He has served as senior scientist for climate studies at NASA’s Marshall Space Flight Center in Huntsville, Alabama. He is known for his satellite-based temperature monitoring work, for which he was awarded the American Meteorological Society's Special Award.
Richard Lindzen is an American atmospheric physicist and Alfred P. Sloan Professor of Meteorology at the Massachusetts Institute of Technology. Lindzen is known for his work in the dynamics of the middle atmosphere, atmospheric tides and ozone photochemistry. He has published more than 200 scientific papers and books. He was a lead author of Chapter 7, 'Physical Climate Processes and Feedbacks,' of the IPCC Third Assessment Report on climate change.
Fred Singer is an Austrian-born American physicist and emeritus professor of environmental science at the University of Virginia. Singer trained as an atmospheric physicist and is known for his work in space research, atmospheric pollution, rocket, and satellite technology.

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GLOBAL WARMING CONCERNS

Unprecedented Warming of the Planet — With respect to air temperature, the climate-alarmist contention is multifaceted. It is claimed that over the past several decades: (a) earth's temperature has risen to a level that is unprecedented over the past millennium or more, (b) the world has been warming at a rate that is equally unprecedented, and (c) both of these dubious achievements have been made possible by the similarly unprecedented magnitude of anthropogenic CO2 emissions, due to humanity's ever-increasing burning of fossil fuels such as coal, gas, and oil.

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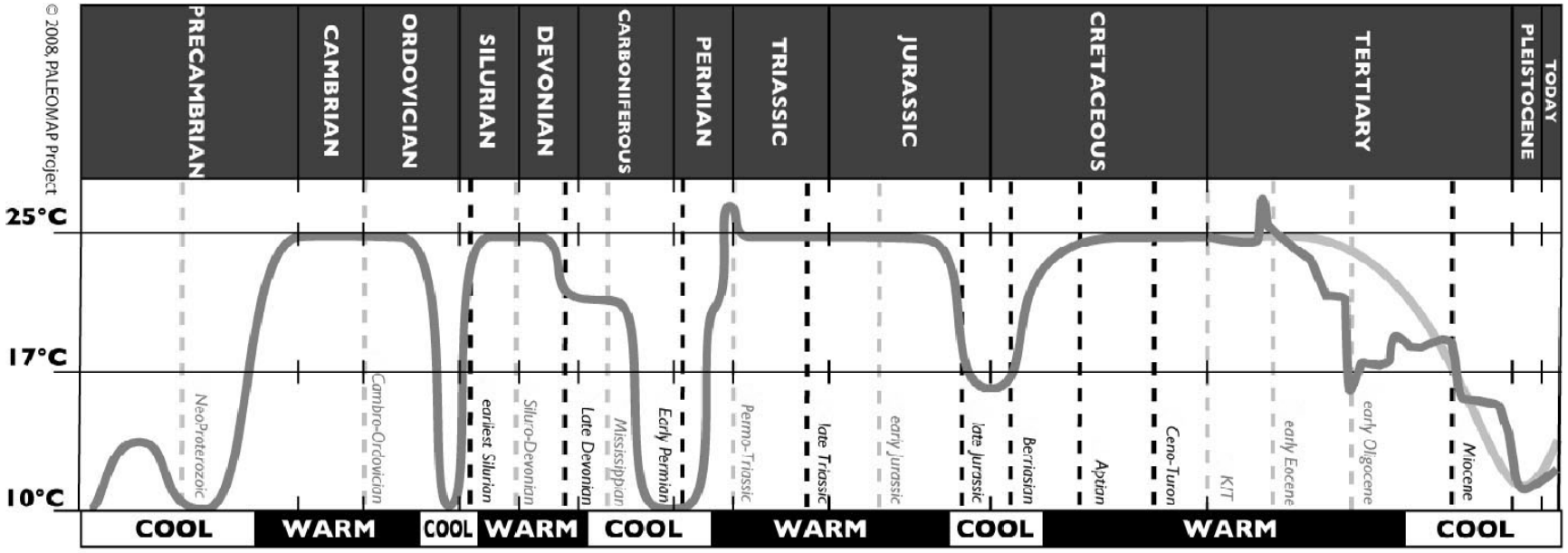
GLOBAL AVERAGE TEMPERATURE OVER THE PAST BILLION YEARS

(We are actually living in a cool period of the Earth's climate history.)



Source: Paleomap Project
Christopher R. Scotese

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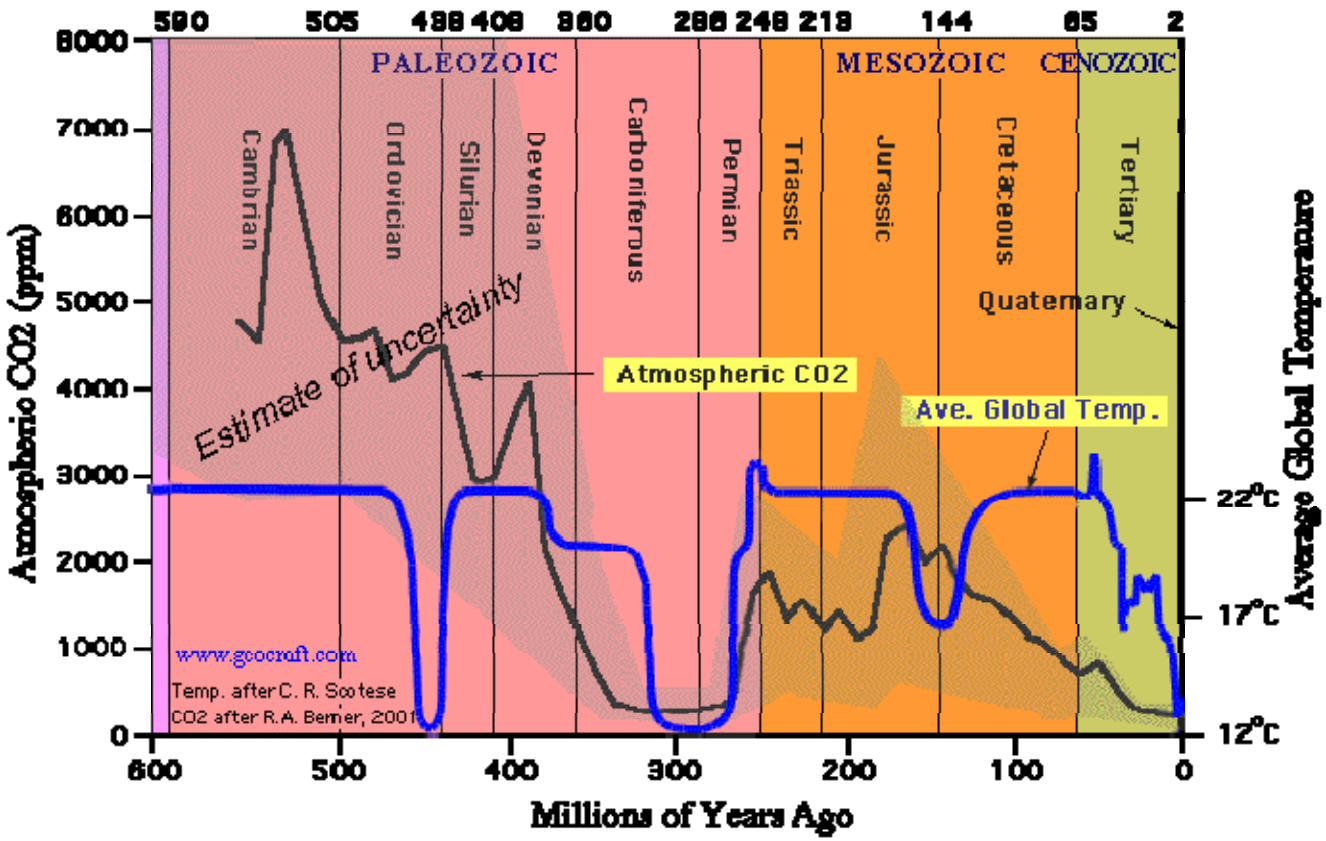
Global Temperature and Atmospheric CO2 over Geologic Time



Source: Monte Hieb, 2009

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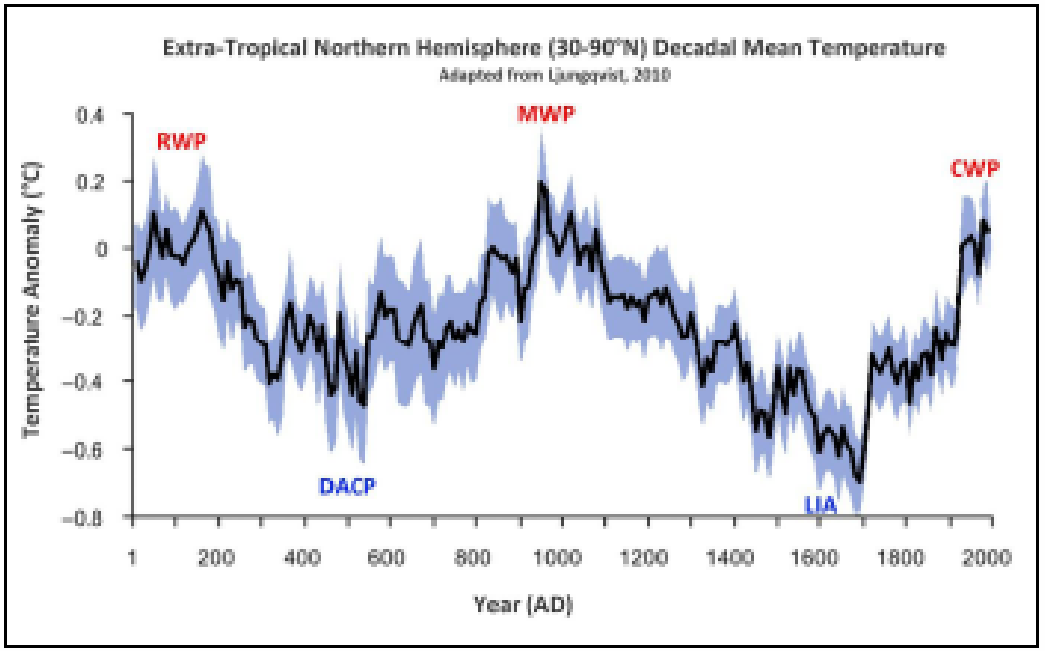
NORTHERN HEMISPHERE MEAN DECADAL TEMPERATURE VARIATIONS RELATIVE TO THE 1961-1990 MEAN



Reconstructed extra-tropical (30-90°N) mean decadal temperature variations relative to the 1961-1990 mean of the variance-adjusted 30-90°N CRUTEM3+HadSST2 instrumental temperature data of Brohan et al. (2006) and Rayner et al. (2006), showing the approximate locations of the Roman Warm Period (RWP), Dark Ages Cold Period (DACP), Medieval Warm Period (MWP), Little Ice Age (LIA) and Current Warm Period (CEP). Adapted from Ljungqvist (2010).

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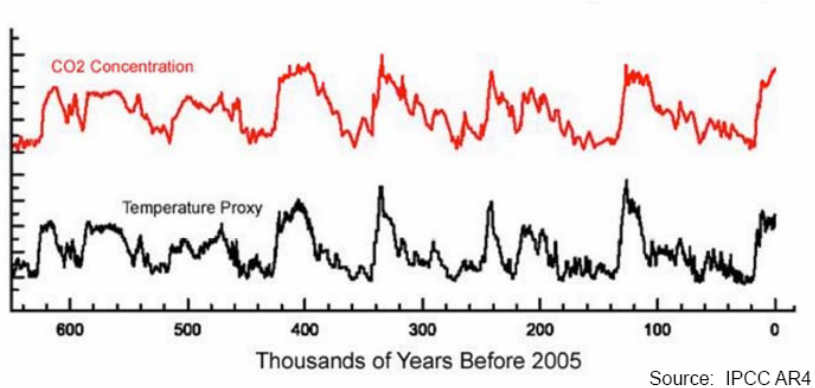
GLOBAL WARMING CO2-TEMPERATURE RELATIONSHIP

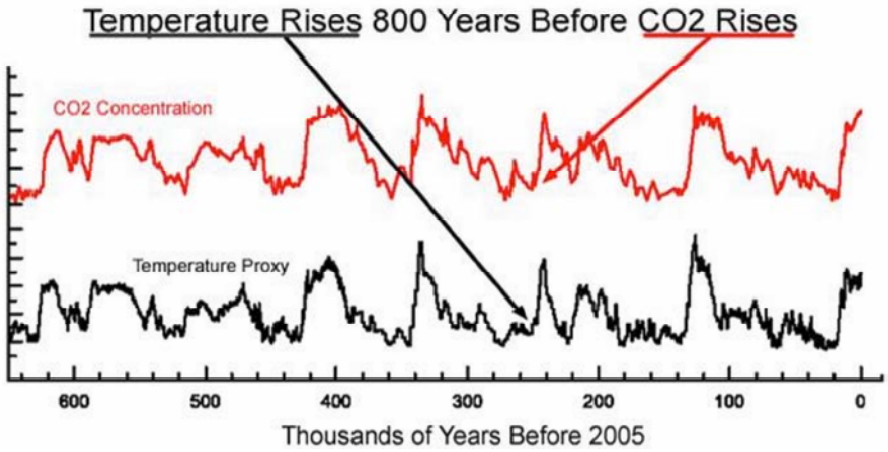
Early Ice Core Studies Seemed to Have Found the Smoking Gun

CO_2 appeared to be a strong driver of global temperatures…



Source: IPCC AR4

More Careful Measurements Have Reversed the Findings



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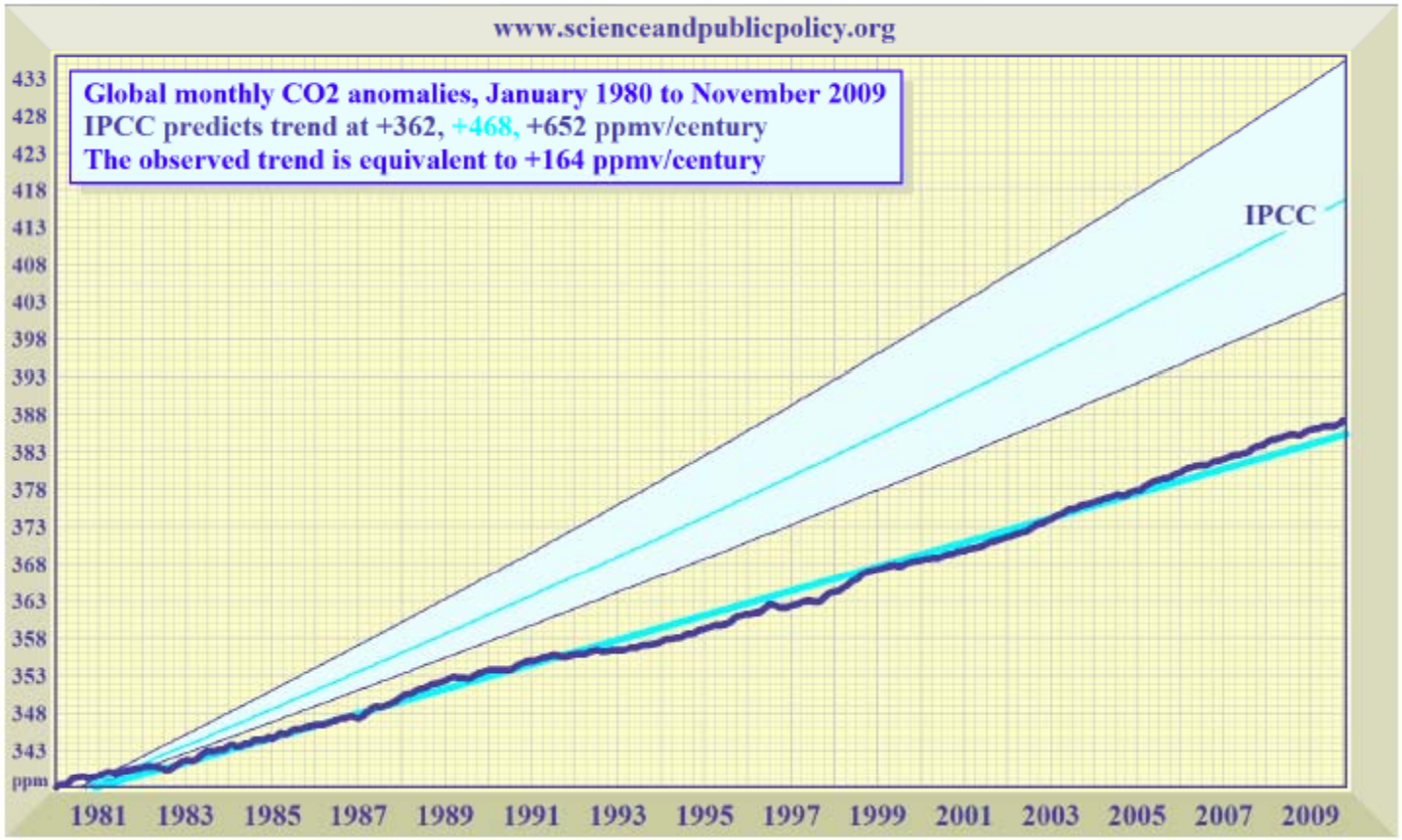
IPCC predicts rapid, exponential CO_2 growth that is not occurring



***Observed CO2 growth is linear**, and is also well below the exponential-growth curves (bounding the pale blue region) predicted by the IPCC in its 2007 report. If CO2 continues on its present path, the IPCC's central temperature projection for the year 2100 must be halved.*
***Data source:** NOAA.*

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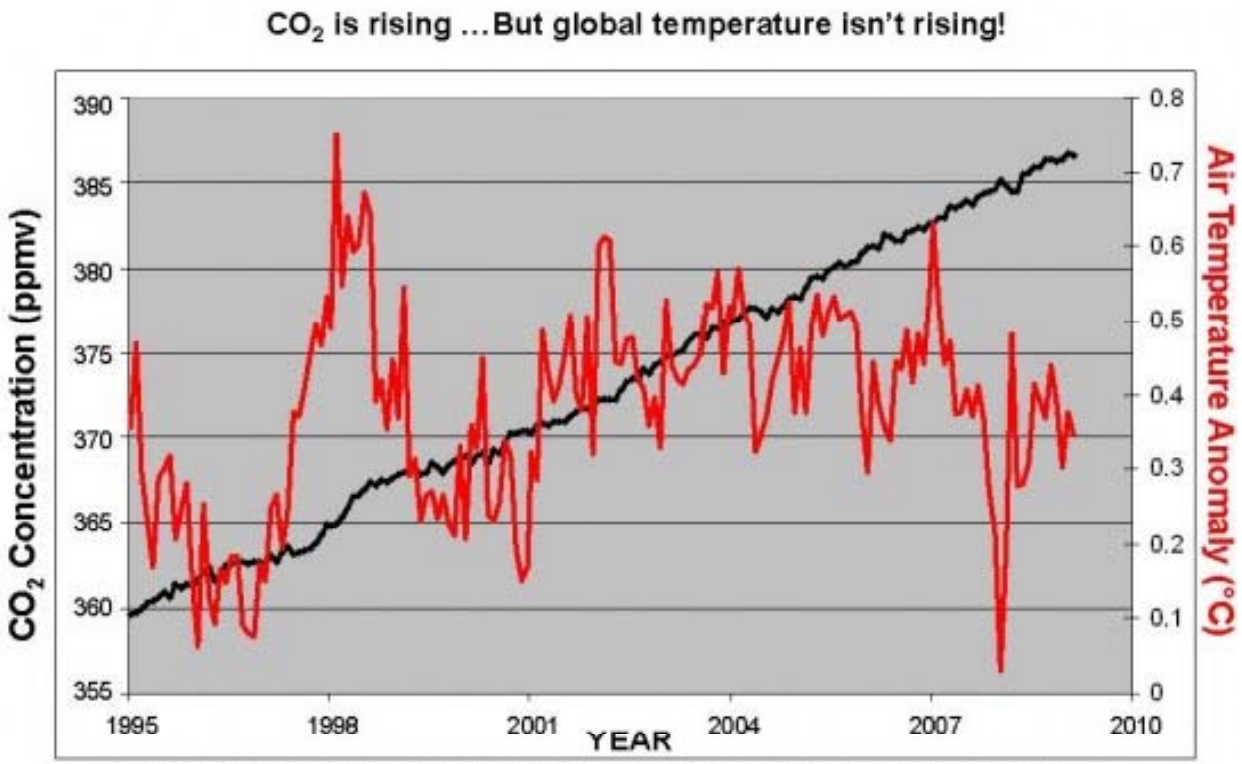
RECENT RELATIONSHIP OF CO2 AND TEMPERATURE



NOTE: CO2 measurements taken at Mauna Loa Observatory in Hawaii (in black, rising) plotted against Global surface temperature since 1995 (in red, steady and falling) taken from Hadley Centre and Climatic Research Unit of the University of East Anglia. These two sets of statistics are used by the IPCC in its reports.

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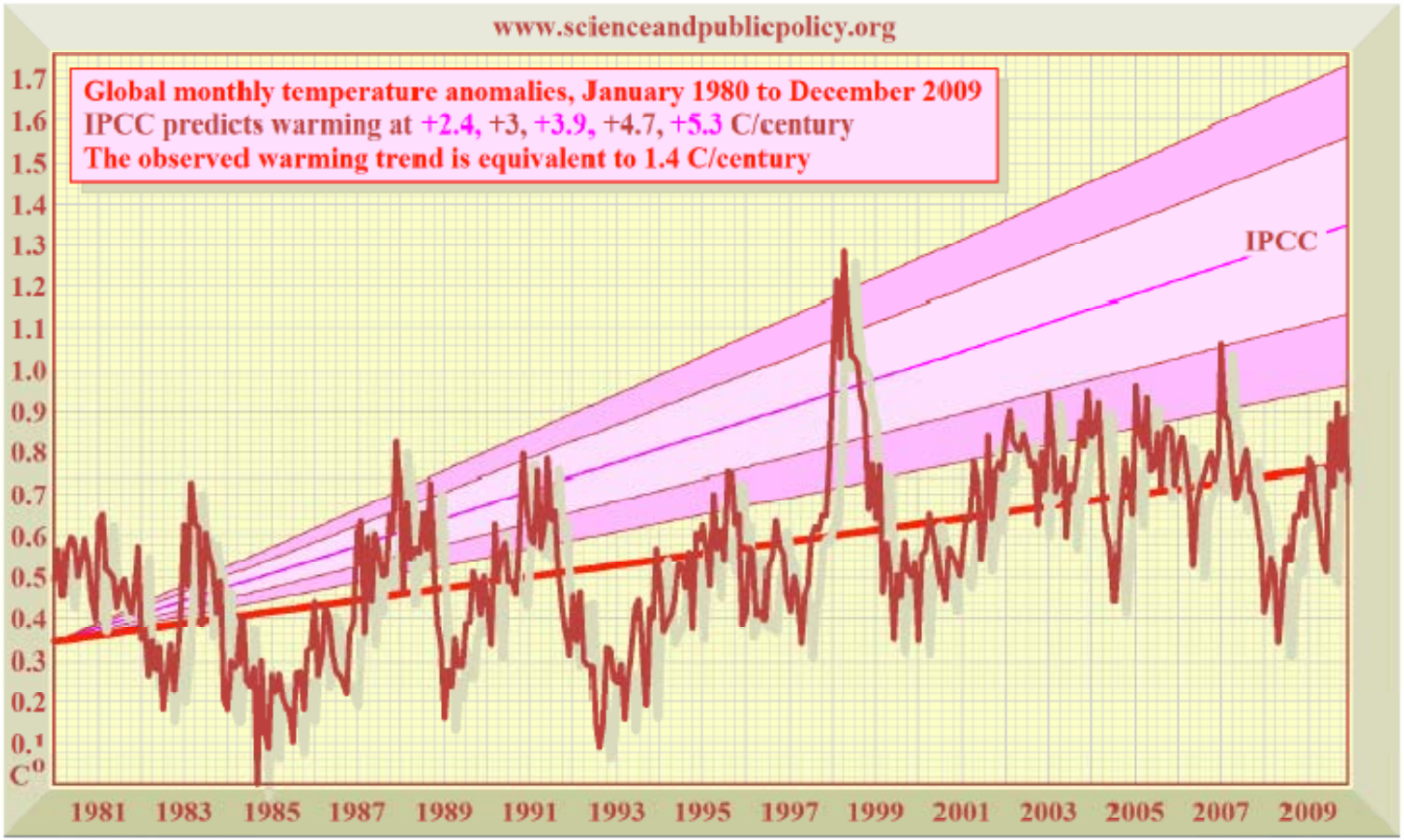
The 29-year global warming trend is just 2.5 °F (1.4 °C) per century



Global temperature *for the past 30 years has been undershooting the IPCC's currently-predicted warming rates (pink region). The warming trend (thick red line) has been rising at well below half of the IPCC's central estimate.* ***Data source:*** *SPPI index, compiled from RSS, and UAH. SPPI no longer uses any terrestrial-temperature datasets, because they have become near-universally discredited as unreliable.*

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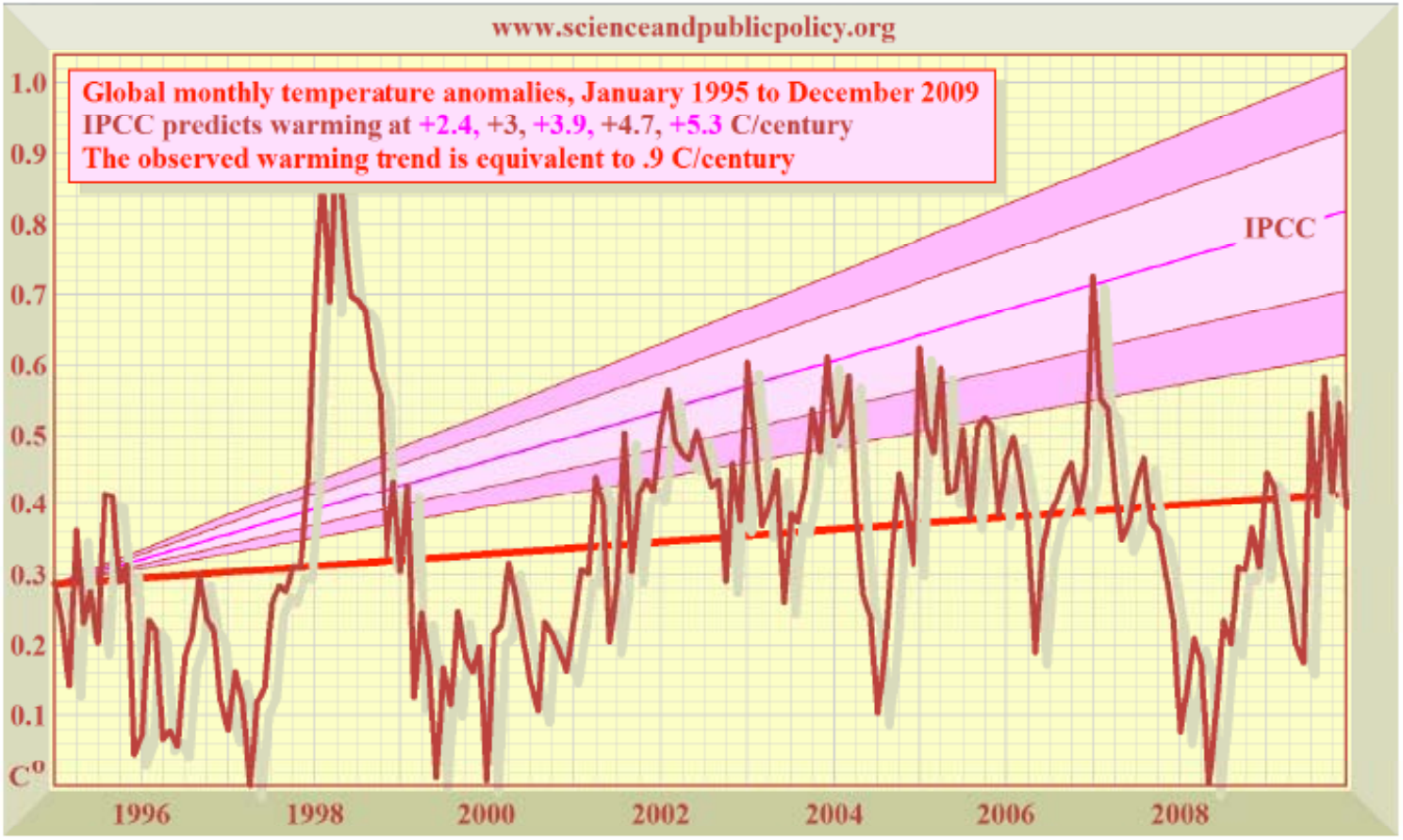
Almost a decade and a half with no statistically-significant warming



Since the beginning of 1995, there has been no statistically-significant "global warming". *The warming over this period would only be significant if the temperature at the end of the period were high enough to be clear of the "error-bars" (not shown in this graph) that reflect the uncertainties in measuring global mean surface temperature accurately.* ***Source:*** *SPPI global temperature index.*

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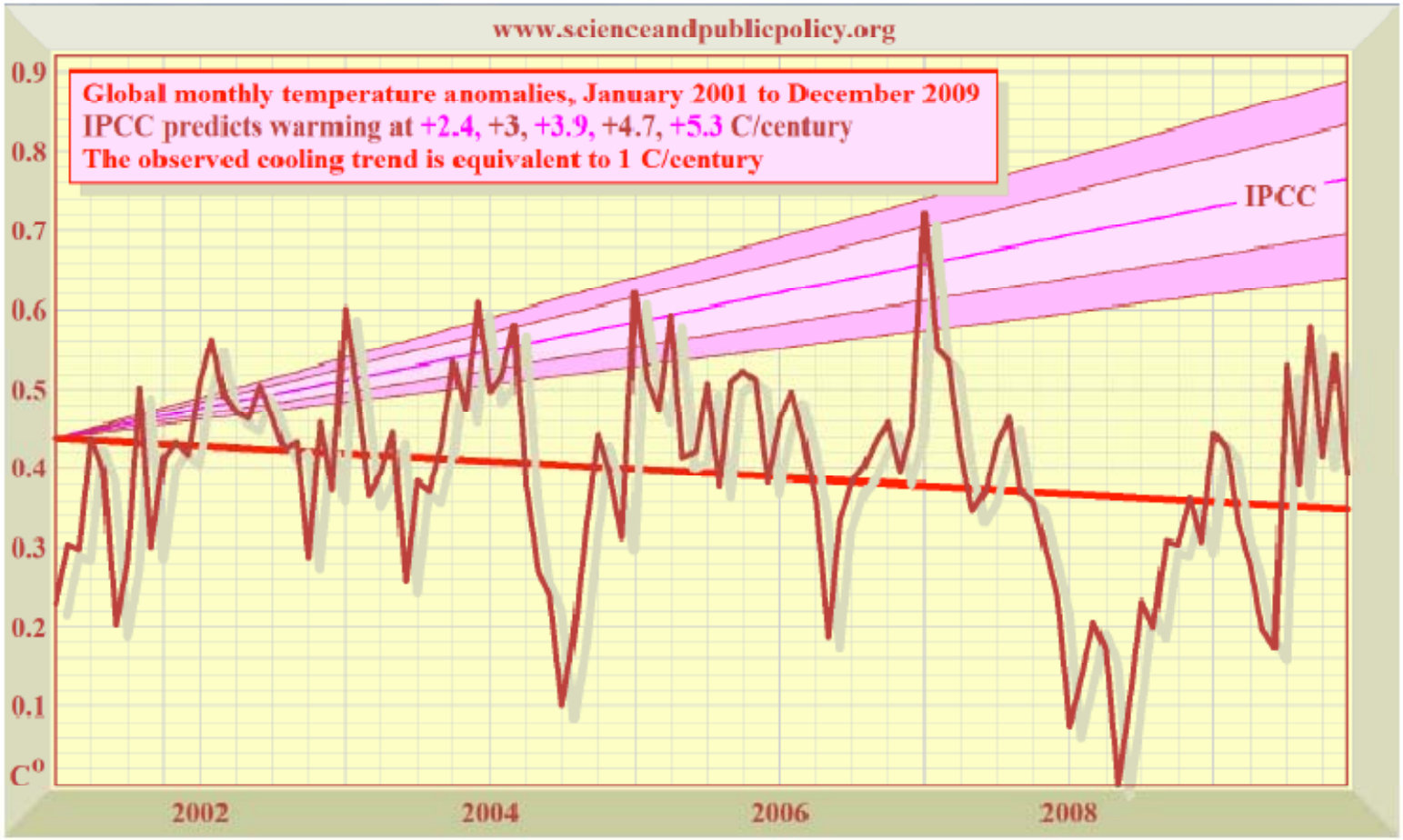
Nine full years' global cooling at 1.8 F° (1 C°) / century



For almost nine years, *the trend global temperatures has been falling rapidly. The IPCC's predicted equilibrium warming path (pink region) bears no relation to the global cooling that has been observed in the 21st century to date.* ***Source:*** *SPPI global temperature index.*

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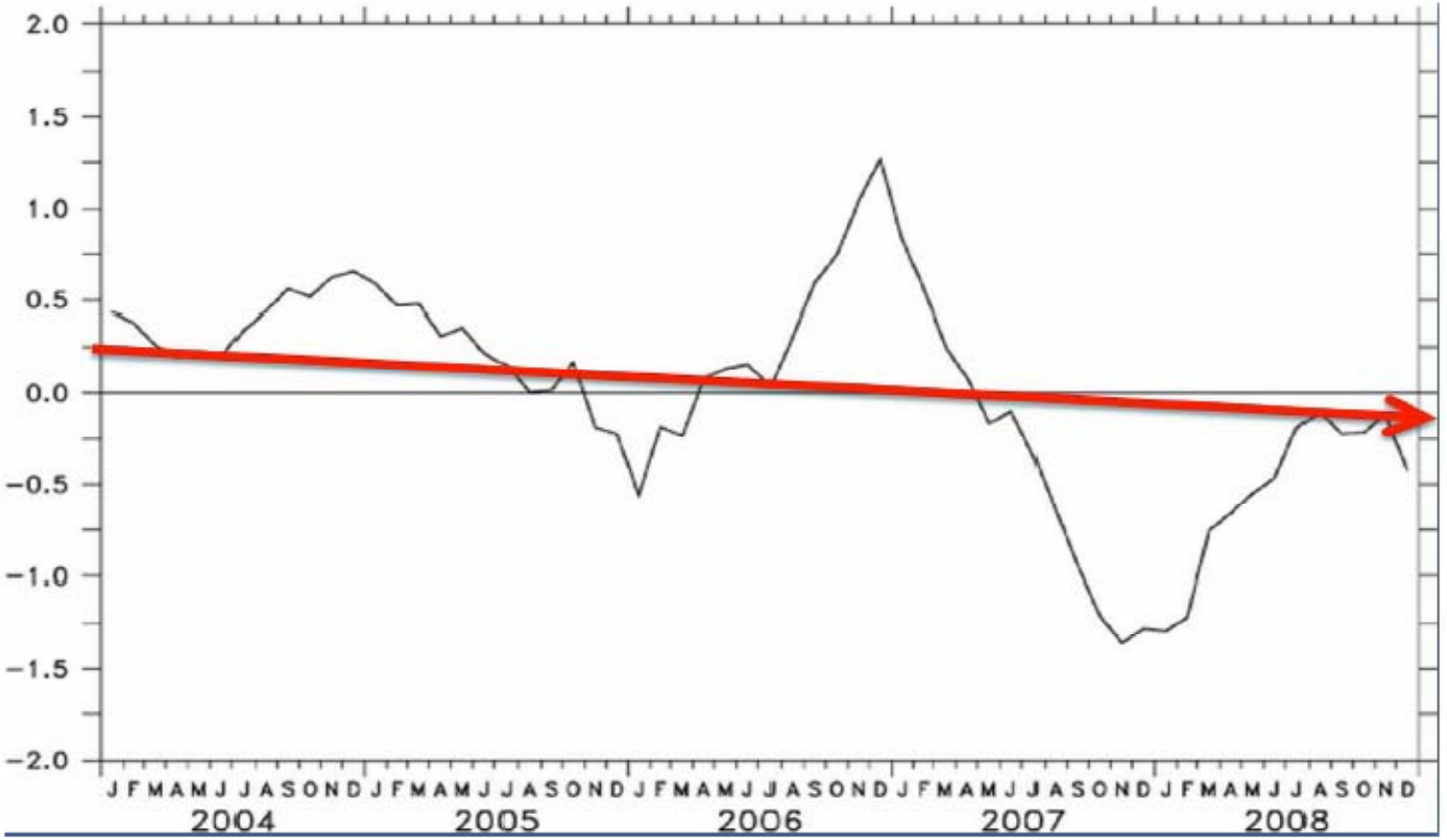
Hard evidence disproves theory: the ocean is not warming



***The 3300 Argo bathythermograph buoys** deployed throughout the world's oceans since late in 2003 have shown a slight cooling of the oceans (anomaly in Celsius degrees: left scale) over the past five years, directly contrary to the official theory that any "global warming" not showing in the atmosphere would definitely show up in the first 400 fathoms of the world's oceans, where at least 80% of any surplus heat would be stored. **Source:** ARGO project, June 2009.*

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GLOBAL WARMING CONCERNS

More Frequent and Severe Hurricanes — CO2-induced global warming will increase the frequency, intensity, and duration of hurricanes.

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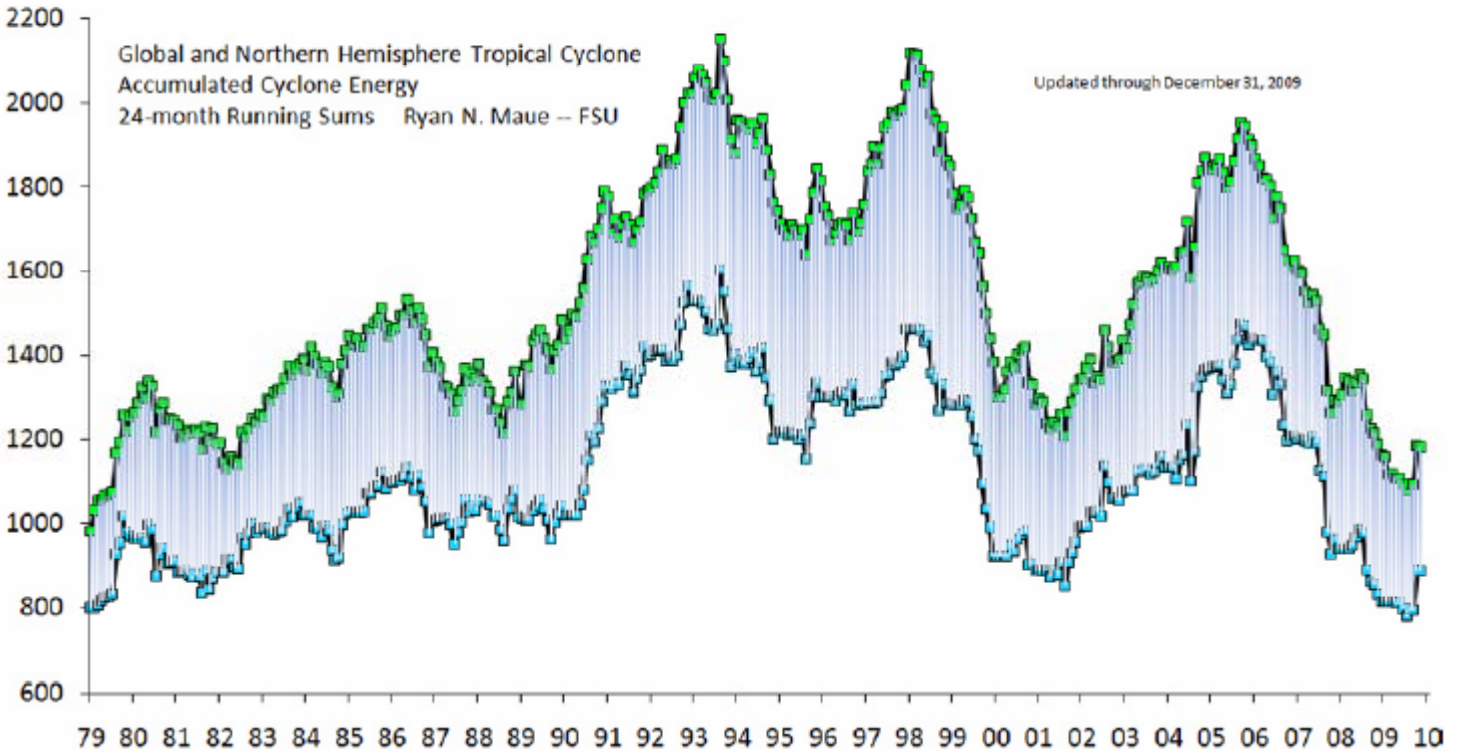
GLOBAL WARMING AND HURRICANES



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GLOBAL WARMING CONCERNS

More Frequent and Severe Floods and Droughts — As a result of the global warming and change in weather patterns that climate models predict will occur in response to the ongoing rise in the air's CO2 content, it is claimed that floods and droughts will become both more numerous and severe throughout the world.

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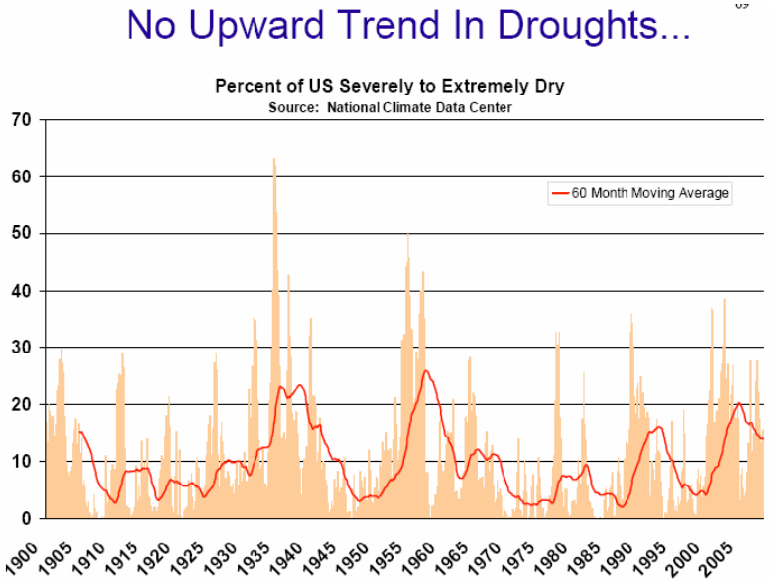
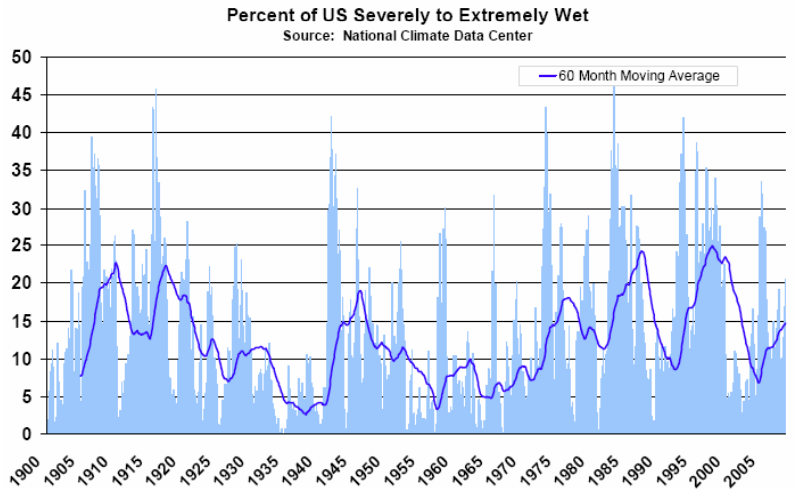
GLOBAL WARMING AND SEVERE WEATHER

No Upward Trend In Droughts...



And No Significant Trend In Wet Weather



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GLOBAL WARMING CONCERNS

Warming will result in loss of polar ice and glaciers, raising sea levels. Loss of polar ice will reduce albedo (reflection of sunlight) and increase warming. Artic may be ice-free within a few years.

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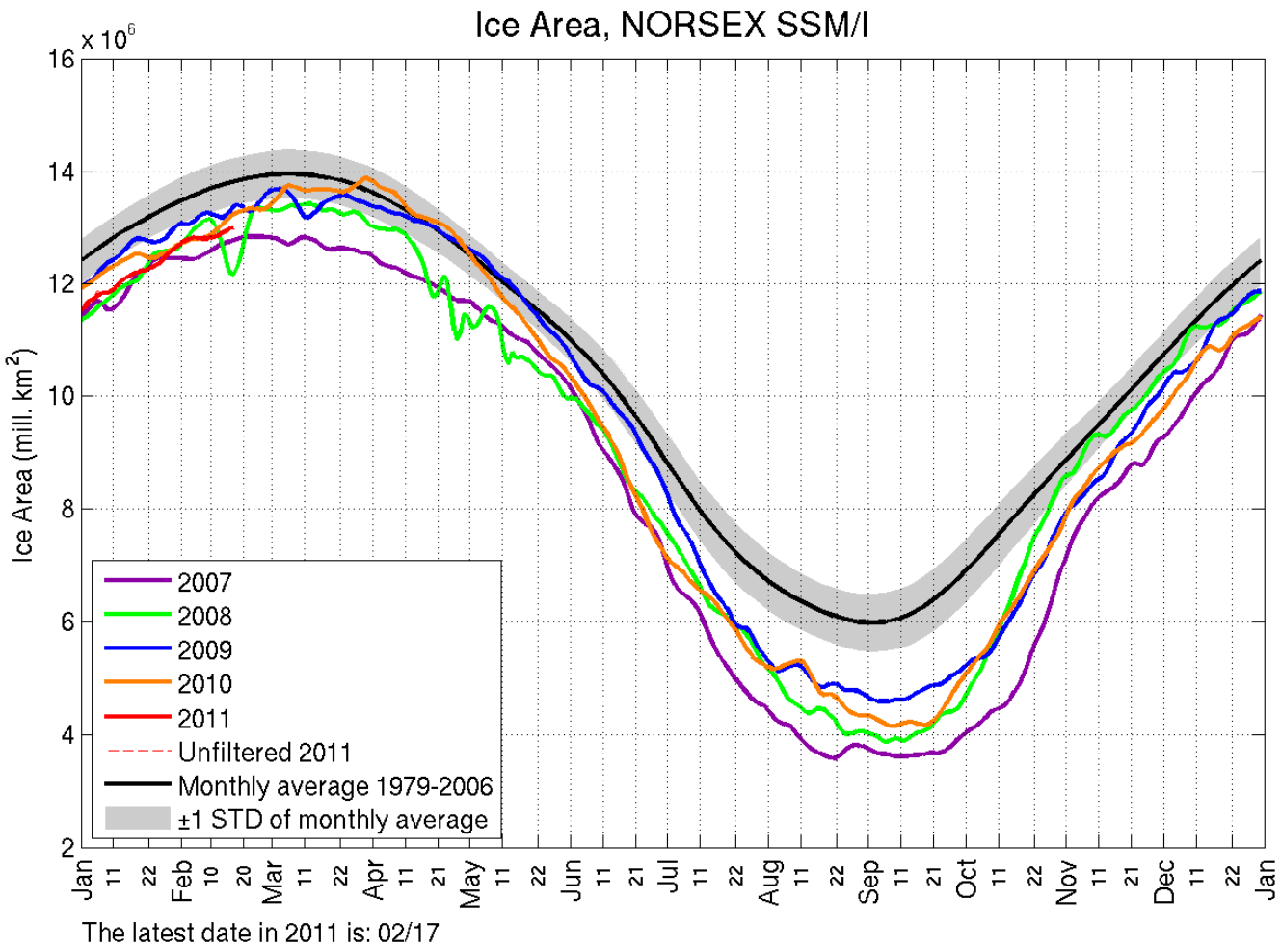
ARCTIC SEA ICE EXTENT



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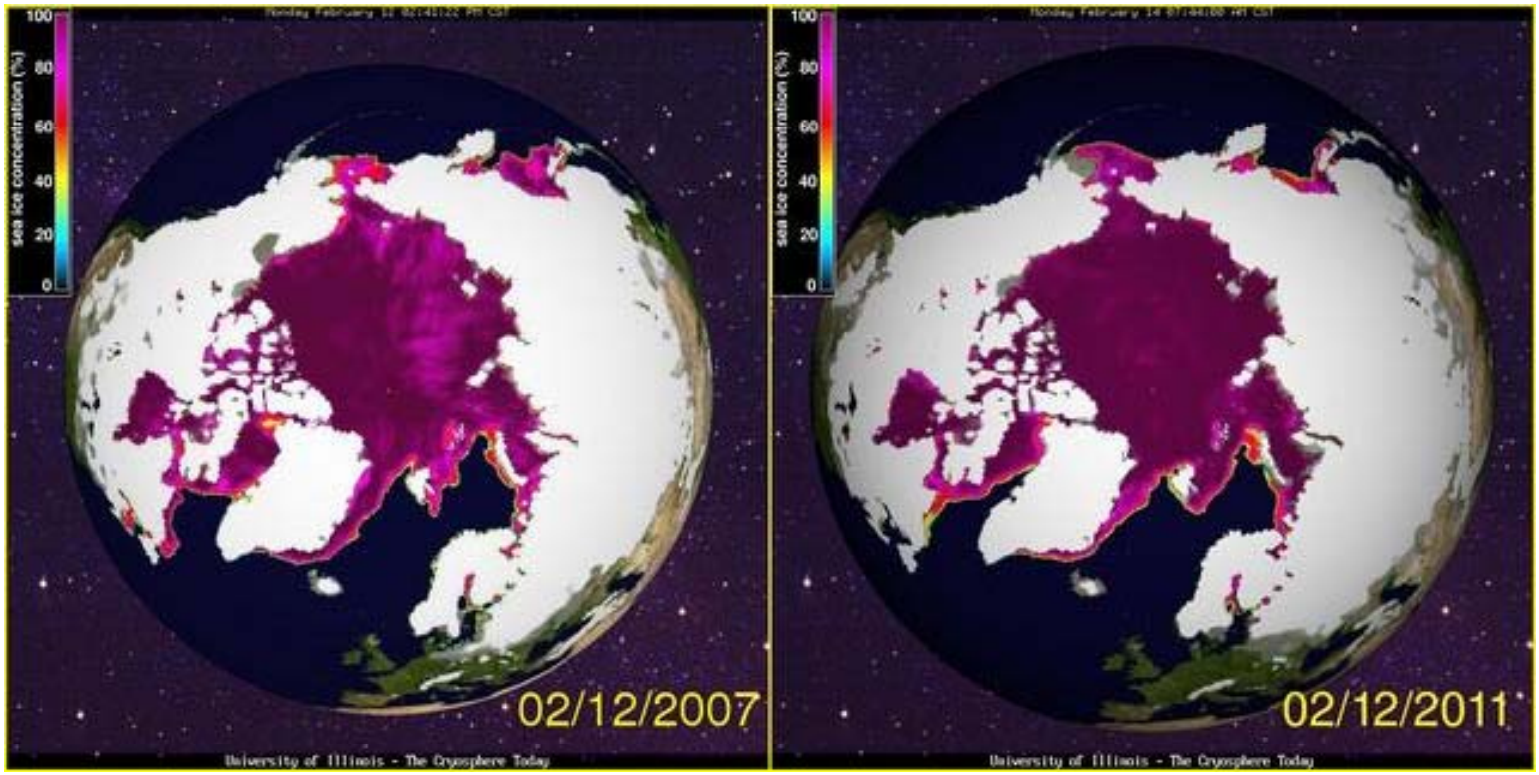
ARCTIC SEA ICE



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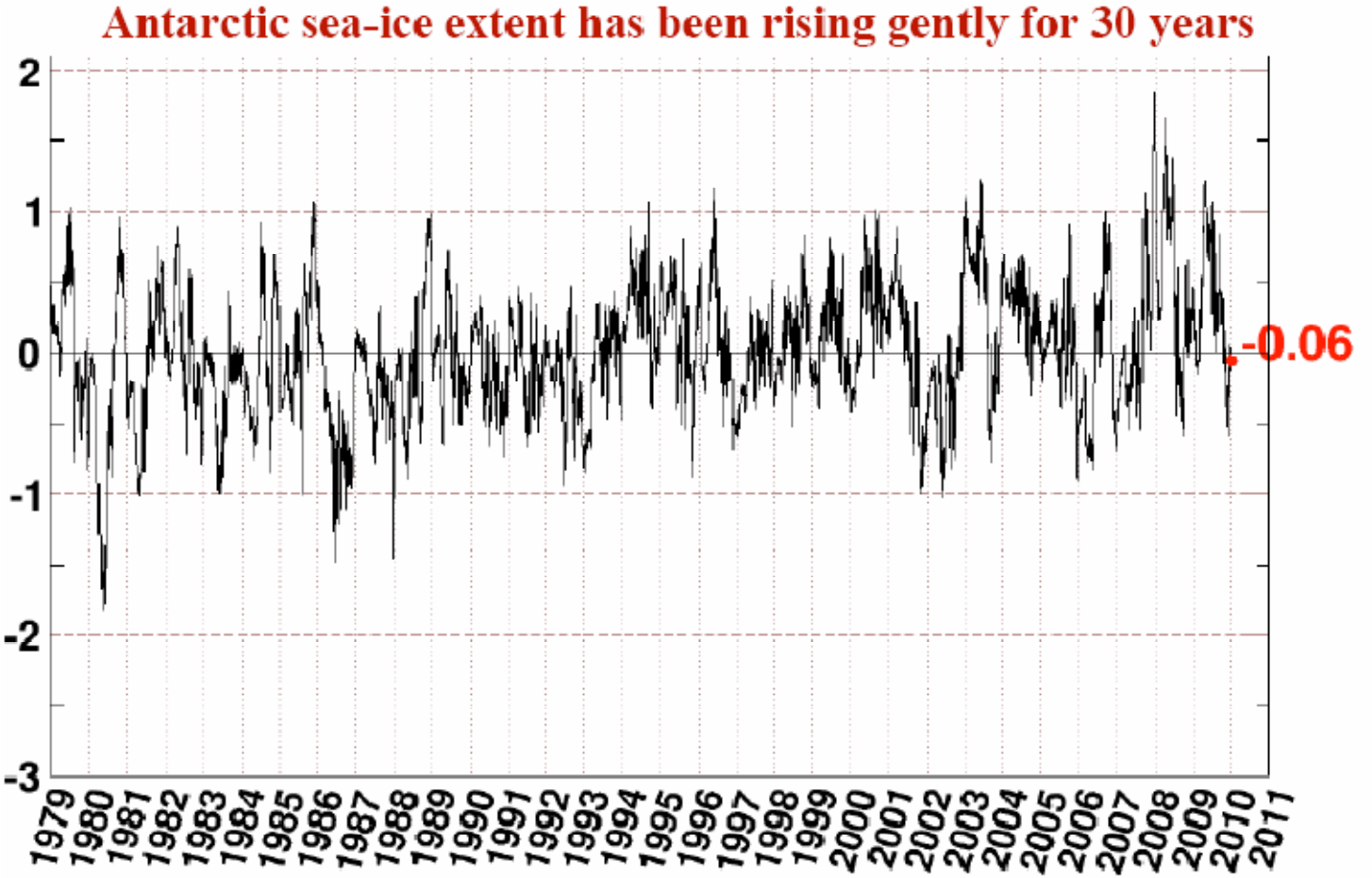
ANTARCTIC SEA ICE EXTENT



Antarctic sea-ice extent (anomaly from 1979-2000 mean, millions of km²: left scale) *shows a gentle but definite uptrend over the past 30 years. The peak extent, which occurred late in 2007, followed shortly after the decline in Arctic sea ice in late summer that year. In the summer of 2009, less Antarctic sea-ice melted than since records began 30 years previously, confirming that global warming is not*

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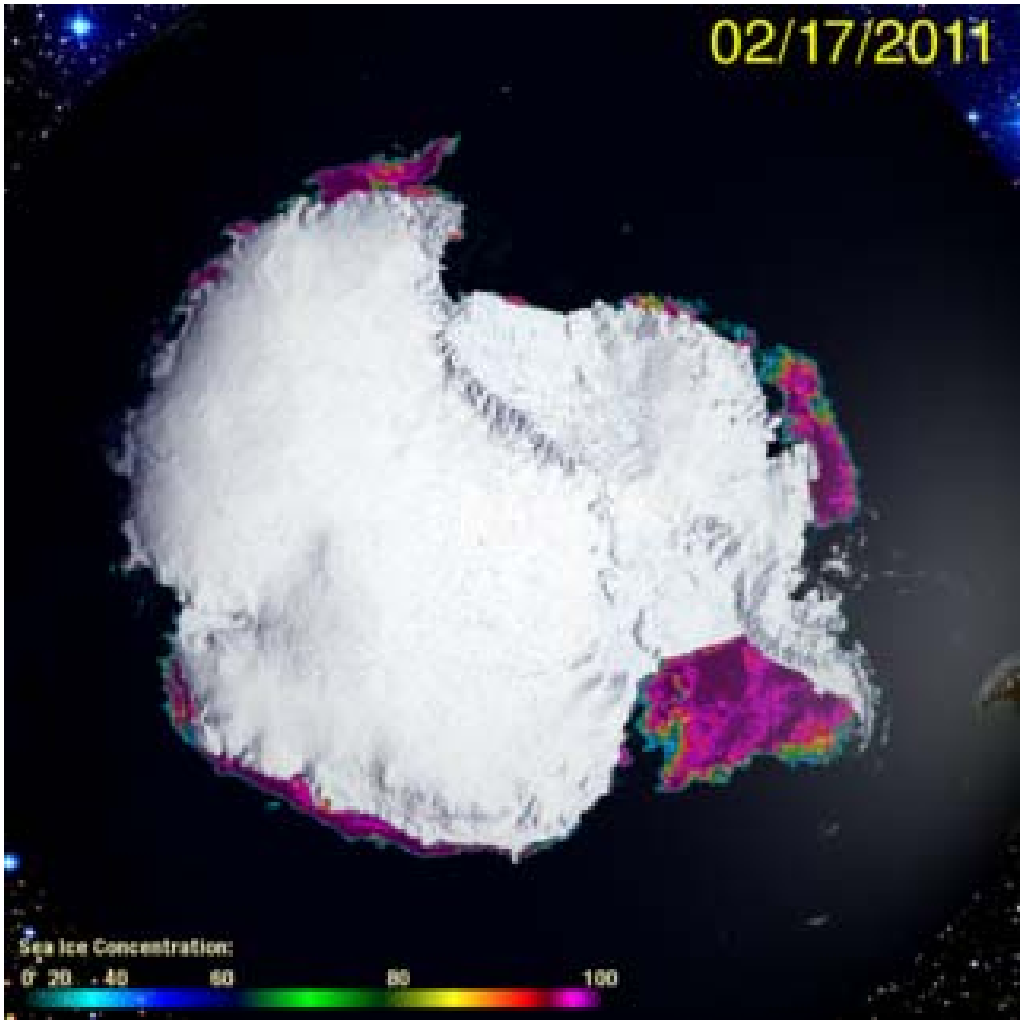
ANARCTICA CONTINENTAL AND SEA ICE



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GLOBAL WARMING CONCERNS

Rising Sea Levels Inundating Coastal Lowlands — Anthropogenic-induced global warming will lead to rapidly melting polar ice sheets, rapidly rising sea levels, and catastrophic coastal flooding.

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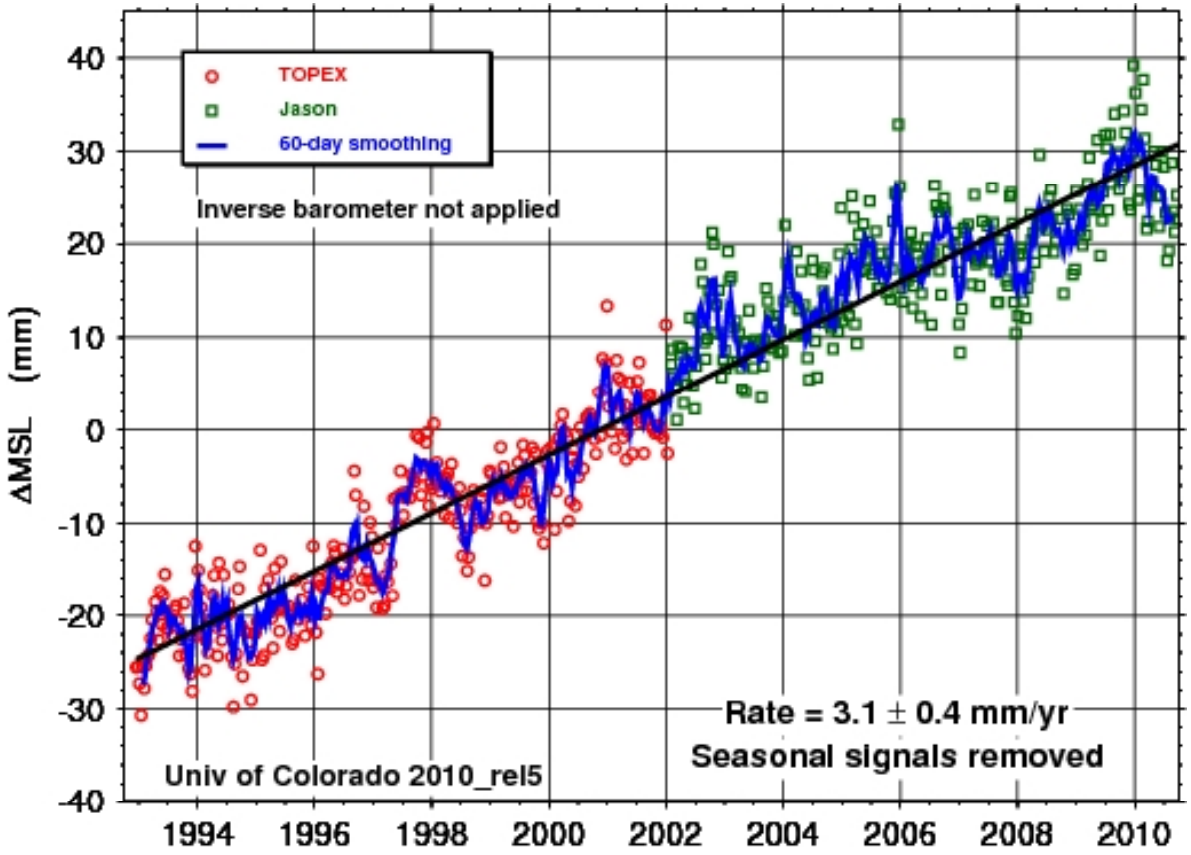
GLOBAL WARMING AND SEA LEVEL



The rate of sea level rise over the past 5 years has been half the overall rate. At the rate of the past 5 years it will be the year 2774 before the oceans rise a single meter.

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GLOBAL WARMING CONCERNS

Other Concerns

- Widespread plant and animal extinctions
- Declining vegetative productivity
- Harmful effects of ocean acidification on many marine species
- Frequent coral bleaching
- Increased human mortality due to more severe and frequent heat waves
- Enhanced spreading of numerous vector-borne diseases

Recent research and peer-reviewed publications indicate the above concerns are either baseless or exaggerated.

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STATUS OF INTERNATIONAL CLIMATE POLICIES

- Kyoto Protocol expires in 2012.
- Last two global climate summits (Copenhagen and Cancun) failed to produce binding agreements and it looks unlikely that there will be a successor for the Kyoto Protocol.
- "A legally binding accord to combat climate change 'is not on the cards' at a December summit [Johannesburg], because developing countries such as China, Brazil and India won't commit to it", according to U.S. negotiator Todd Stern.
- UN leadership (Ban Ki Moon) has withdrawn from active participation in climate efforts.
- UNIPCC's AR4 report has been heavily criticized and calls have been made for review and revision of its policies and procedures.
- EU continues carbon market, but has now had several serious incidents of fraud with financial losses in the billions.
- The Chicago Climate Exchange in the U.S. has closed.
- Australia and Canada have abandoned national cap-and-trade programs.
- Political changes following the November 2010 elections suggest the U.S. will have less interest in UN climate efforts.
- UN this week said it wants 2 percent of world income put into "green economy".

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CURRENT STATUS OF CLIMATE CHANGE SCIENCE

SUMMARY

- There is no crisis.
- Science and empirical observations have caught up with alarmist propaganda.
- UN IPPC 2007 AR4 report shredded for inaccuracies, misinformation, alarmism, and extensive use of non-peer reviewed sources.
- Climate science and empirical climate data gathered over past decade do not support UN IPCC projections.
- As measured by polls, public concern about global warming has declined significantly. A January 2010 Pew poll showed global warming dead last on a list of concerns. According to a recent Gallup poll, a growing number of Americans, nearly half the country, think global warming worries are exaggerated and more people doubt that scientific warnings of severe environmental fallout will ever occur.

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1970's GLOBAL COOLING SCARE

SCIENCE

The Cooling World

There are ominous signs that the earth's weather patterns have begun to change dramatically and that these changes may portend a drastic decline in food production—with serious political implications for just about every nation on earth. The drop in food output could begin quite soon, perhaps only ten years from now. The regions destined to feel its impact are the great wheat-producing lands of Canada and the U.S.S.R. in the north, along with a number of marginally self-sufficient tropical areas—parts of India, Pakistan, Bangladesh, Indochina and Indonesia—where the growing season is dependent upon the rains brought by the monsoon.

The evidence in support of these predictions has now begun to accumulate so massively that meteorologists are hard-pressed to keep up with it. In England, farmers have seen their growing season decline by about two weeks since 1950, with a resultant over-all loss in grain production estimated at up to 100,000 tons annually. During the same time, the average temperature around the equator has risen by a fraction of a degree—a fraction that in some areas can mean drought and desolation. Last April, in the most devastating outbreak of tornadoes ever recorded, 148 twisters killed more than 300 people and caused half a billion dollars' worth of damage in thirteen U.S. states.

Trend: To scientists, these seemingly disparate incidents represent the advance signs of fundamental changes in the world's weather. The central fact is that after three quarters of a century of extraordinarily mild conditions, the earth's climate seems to be cooling down. Meteorologists disagree about the cause and extent of the cooling trend, as well as over its specific impact on local weather conditions. But they are almost unanimous in the view that the trend will reduce agricultural productivity for the rest of the century. If the climatic change is as profound as some of the pessimists fear, the resulting famines could be catastrophic. "A major climatic change would force economic and social adjustments on a worldwide scale," warns a recent report by the National Academy of Sciences, "because the global patterns of food production and population that have evolved are implicitly dependent on the climate of the present century."

A survey completed last year by Dr. Murray Mitchell of the National Oceanic and Atmospheric Administration reveals a drop of half a degree in average ground temperatures in the Northern Hemisphere between 1945 and 1968. According to George Kukla of Columbia University, satellite photos indicated a sudden, large increase in Northern Hemisphere snow cover in the winter of 1971-72. And a study released last month by two NOAA scientists notes that the amount of sunshine reaching the ground in the continental U.S. diminished by 1.3 per cent between 1964 and 1972.

To the layman, the relatively small changes in temperature and sunshine can be highly misleading. Reid Bryson of the University of Wisconsin points out that the earth's average temperature during the great Ice Ages was only about 7 degrees lower than during its warmest eras—and that the present decline has taken the planet about a sixth of the way toward the Ice Age average. Others regard the cooling as a reversion to the "little ice age" conditions that brought bitter winters to much of Europe and northern America between 1600 and 1900—years when the Thames used to freeze so solidly that Londoners roasted oxen on the ice and when iceboats sailed the Hudson River almost as far south as New York City.

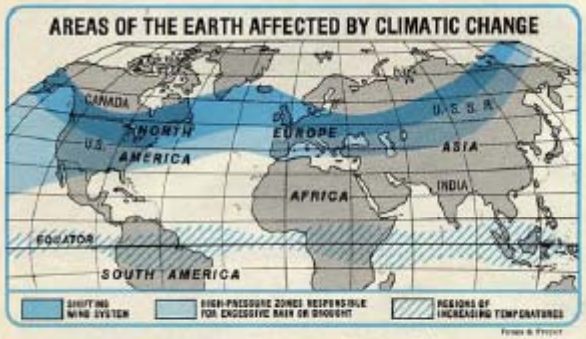
Just what causes the onset of major and minor ice ages remains a mystery. "Our knowledge of the mechanisms of climatic change is at least as fragmentary as our data," concedes the National Academy of Sciences report. "Not only are the basic scientific questions largely unanswered, but in many cases we do not yet know enough to pose the key questions."

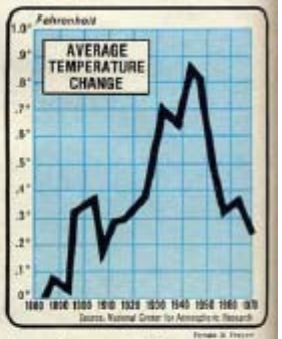
Extremes: Meteorologists think that they can forecast the short-term results of the return to the norm of the last century. They begin by noting the slight drop in over-all temperature that produces large numbers of pressure centers in the upper atmosphere. These break up the smooth flow of westerly winds over temperate areas. The stagnant air produced in this way causes an increase in extremes of local weather such as droughts, floods, extended dry spells, long freezes, delayed monsoons and even local temperature increases—all of which have a direct impact on food supplies.

"The world's food-producing system," warns Dr. James D. McQuigg of NOAA's Center for Climatic and Environmental Assessment, "is much more sensitive to the weather variable than it was even five years ago." Furthermore, the growth of world population and creation of new national boundaries make it impossible for starving peoples to migrate from their devastated fields, as they did during past famines.

Climatologists are pessimistic that political leaders will take any positive action to compensate for the climatic change, or even to allay its effects. They concede that some of the more spectacular solutions proposed, such as melting the arctic ice cap by covering it with black soot or diverting arctic rivers, might create problems far greater than those they solve. But the scientists see few signs that government leaders anywhere are even prepared to take the simple measures of stockpiling food or of introducing the variables of climatic uncertainty into economic projections of future food supplies. The longer the planners delay, the more difficult will they find it to cope with climatic change once the results become grim reality.

—PETER GWYNNE with bureau reports





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QUESTIONS/DISCUSSION

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BREAK

OVERVIEW OF CLIMATE CHANGE SCIENCE AND POLICIES

PRESENTATION OUTLINE

Session 2

- **Federal & State Policies**
- **Mitigation Technologies**
- **Questions/Discussion**

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FEDERAL & STATE POLICIES

Obama Administration

- President-elect Obama highlighted the need to address global warming during his campaign and has made it a high priority in his administration. He set a target for reducing U.S. greenhouse gas (GHG) emissions back to 1990 levels by 2020.
- Newly established positions (e.g. czars, climate envoy) and agency appointments demonstrated his commitment to dealing with global warming.
- In 2009, Obama issued an Executive Order that required each federal agency to measure its greenhouse-gas emissions for the first time and set targets to reduce them by 2020.
- Obama's January 2010 EO13514, specifies that each federal agency must produce a plan and submit to the executive branch in short order. The plan calls for the declaration of a percentage reduction in greenhouse gas emissions over the next 10 years. Overall, a 28% reduction in federal GHG is required by 2020.
- Following the Copenhagen Climate Summit in December 2009, the Obama Administration Committed to GHG cuts under the Copenhagen Climate Accord – 4% below 1990 levels by 2020 (~17% below 2005 levels).
- During his recent State of the Union speech, President Obama articulated two national goals: 80% of electricity from "clean" energy by 2035 and one million electric vehicles "on the road" by 2015 (just four years from now). (Another way of skinning the cat)
- President Obama's FY2012 budget included some cuts, but spared key climate change science and monitoring programs – including funding for a new Climate Service.

FEDERAL & STATE POLICIES

Congress

110th – 111th Congress (2007-2011)

Numerous attempts at climate legislation (e.g. cap-and-trade) in both house and senate – all fail.

112th Congress (2011-13)

- New GOP- controlled House passes Continuing Resolution for FY2011 funding with $61 billion in federal funding cuts including cuts resulting in:
  - Barring EPA from using funds to regulate GHG emissions from stationary sources
  - Elimination of a $25 million increase President Obama proposed to add to the FY2011 budget for state and local GHG permitting activities
  - A block on NOAA putting its funds toward a planned "Climate Service"
  - Barring federal funding from going to UNIPCC
  - Prohibits funds for Climate Change Envoy
  - Blocking EPA from implementing its E15 waiver allowing use of higher amounts of ethanol in fuels from model year 2001 onward
  - Barring funding for "czars" e.g. Browner and Holdren
- House CR faces substantial revision in the Senate and possible presidential veto of funding blocks for climate/environmental programs.
- Expect greater scrutiny and hearings in the House related to climate science and programs. Rep. Paul Broun (R-GA) Chair of the House Science, Space, and Technology Committee's oversight panel is planning hearings aimed at showing that climate science is unsettled.

FEDERAL & STATE POLICIES

Federal Agencies

Global warming/climate change activities and programs can be found throughout practically all federal agencies. Shown below is a table from the National Association for the Advancement of Science (Chapter 15, Climate Change in the FY2011 Budget).

Table 1. Climate Change in the Federal R&D Budget
(budget authority in millions of dollars)

	FY 2009 Actual	ARRA Estimate	FY 2010 Estimate	FY 2011 Budget	Change FY 10-11 Amount	Change FY 10-11 Percent
US Global Change Res Prog	2,059	604	2,122	2,561	439	20.7%
Natl Oceanic & Atmos Admin						
USGCRP	*424*	*170*	*360*	*437*	*77*	*21.4%*
National Science Foundation						
USGCRP	*269*	*121*	*319*	*370*	*51*	*16.0%*
Geosciences	*809*	*347*	*890*	*955*	*66*	*7.4%*
Atmospheric Sciences	*246*	*68*	*260*	*281*	*21*	*8.1%*
Earth Sciences	*171*	*85*	*183*	*199*	*16*	*8.7%*
Sci, Eng and Edu for Sustain			*661*	*766*	*105*	*15.9%*
Natl Aero and Space Admin						
Earth Science	*1,377*	*325*	*1,421*	*1,802*	*381*	*26.8%*
Department of Energy						
Office of Science	*4,813*	*1,633*	*4,904*	*5,121*	*218*	*4.4%*
Bio and Environ Research	*585*	*166*	*604*	*627*	*23*	*3.8%*
Energy R&D	*2,104*	*1,560*	*2,275*	*2,430*	*155*	*6.8%*
Department of Interior						
Climate Change Adaptation	*45*	*0*	*136*	*171*	*35*	*26.0%*
Renewable Energy	*0*	*0*	*59*	*73*	*14*	*24.0%*
Environ Prot Agency R&D	563	0	595	606	11	1.8%
US Dept of Agriculture						
Climate Change	*52*	*0*	*112*	*159*	*47*	*42.0%*
Renewable Energy	*88*	*0*	*127*	*179*	*52*	*40.9%*

Source: Agency budget justifications, budget supplements, and other agency communications.
All figures rounded to the nearest million. Changes calculated from unrounded figures.

"This year your government will spend in the neighborhood of $4 billion ($10.6 million a day) on global warming research despite the fact that there has been no global warming since 1998, and despite all of the billions that have been spent so far yielding no conclusive evidence that using fossil fuels to make energy has any significant effect on Earth's temperature."
Art Horn Blog, January 15, 2011

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FEDERAL & STATE POLICIES

Funding for Clean Energy Technology Programs
FY 2012 Budget

Funding for Clean Energy Technology Programs FY 2012 Budget		
($ in millions)	2010*	2012
Environmental Protection Agency	134	130
Department of Agriculture	803	534
Department of Commerce - NIST	34	63
Department of Defense	333	348
Department of Energy	4,146	6,340
Tennessee Valley Authority	6	6
Department of Housing and Urban Development	30	-
Department of Transportation	149	134
National Aeronautics and Space Administration	228	282
National Science Foundation	373	377
Nuclear Regulatory Commission	100	93
Total	**6,577**	**8,707**

* FY 2010 data excludes earmarks

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FEDERAL & STATE POLICIES

Page 146 Obama Administration FY 2012 Budget [EPA]

"Supports efforts to mitigate climate change and the transition to a clean energy economy."

"The Administration continues to support greenhouse gas emissions reduction in the United States in the range of 17 percent below 2006 levels by 2020 and 83 percent by 2050."

and tribal categorical grants and the agency's core operating budget, which includes enforcement of environment and public health protections. Because of the constrained fiscal environment, the Budget decreases the State Revolving Funds (SRFs) by nearly $950 million while supporting a long-term goal of providing about 5 percent of total water infrastructure spending and spurring more efficient system-wide planning. The Budget also reduces the Great Lakes Restoration Initiative by $125 million, eliminates about $160 million in targeted water infrastructure earmarks, and terminates the $80 million clean diesel grant program.

Prepares the United States to be a Global Leader in the Clean Energy Economy

Supports Efforts to Mitigate Climate Change and the Transition to a Clean Energy Economy. The President has called on the Congress to enact forward-looking energy legislation that would spur U.S. development of advanced, clean energy technologies to reduce the Nation's dependence on oil, strengthen energy and national security, create new jobs, and restore America's position as a global leader in efforts to mitigate climate change and address its consequences. The Administration continues to support greenhouse gas emissions reductions in the United States in the range of 17 percent below 2005 levels by 2020 and 83 percent by 2050.

Reduces Greenhouse Gas (GHG) Emissions and Boosts Fuel Economy. EPA will continue to collaborate with Federal and State agencies as well as regulated sources of GHG emissions to seek cost-effective emissions reductions strategies. Beginning with model year 2012, EPA will begin to implement a historic national program to reduce GHGs and improve fuel economy for cars and trucks, projected to save 1.8 billion barrels of oil and reduce U.S. GHG emissions by 960 million metric tons over the lifetime of vehicles sold during 2012 through 2016. The Agency will also develop a framework for setting GHG standards for light-duty vehicles of model years 2017 and beyond, helping to produce a new generation of clean vehicles and providing sufficient lead time to vehicle manufacturers. The Administration proposes $25 million for State grants to implement permitting programs tailored to GHG emissions. Additionally, EPA will continue to develop regulatory strategies to control GHG emissions from major stationary sources. The Administration also maintains funding levels for partnership and voluntary programs like Energy Star, which help conserve energy and bring down utility bills.

Revitalizes Ecosystems and Communities

Works to Restore the Gulf Coast Ecosystem. The Administration is committed to restoring and protecting the Gulf Coast ecosystem following the BP Deepwater Horizon oil spill and is working with the Gulf States through the Natural Resource Damage Assessment and Restoration process to restore the area's natural resources to pre-spill conditions. A portion of civil penalties obtained from parties responsible for the oil spill, if approved by the Congress to be dedicated to the Gulf Coast restoration, will be an important resource for funding additional critical ecosystem activities, and a key component of the Administration's response to the environmental, economic, and health needs of the region. The President established a Gulf Coast Ecosystem Restoration Task Force by Executive Order that includes Federal and State members. As Chair of the Gulf Coast Ecosystem Restoration Task Force, the EPA Administrator will lead environmental recovery efforts in the region.

Supports Restoration of the Chesapeake Bay. Funding for Chesapeake Bay restoration is increased to support Bay watershed States as they implement their plans to reduce nutrient and sediment pollution in an unprecedented effort to restore this economically important ecosystem. EPA and Federal partners will continue to coordinate with States, Tribes, municipalities, and industry to restore the integrity of imperiled waters of the United States.

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FEDERAL & STATE POLICIES

Federal Agencies

- NASA, NOAA, DOE, DOI all have massive budgets and programs for climate research and monitoring.
- It was announced in a February 18th 2011 news article (ClimateWire) that the Department of Agriculture has launched a $60 million program to assess climate impact on crops and trees.
- The President's Council on Environmental Quality now requires consideration of climate impacts in NEPA Environmental Impact Statements.
- Recently, the Securities and Exchange Commission issued guidance regarding disclosure related to climate change.
- EPA and DOT recently announced new mileage and GHG tailpipe standards for light duty vehicles (recently proposed for HDV).
- EPA has promulgated numerous GHG-related regulations including:
  - GHG monitoring and reporting
  - GHG specifications in the national Renewable Fuels Standards
  - EPA new PSD – Title V GHG permitting rules

FEDERAL & STATE CLIMATE POLICIES

U.S. State and Regional Climate Actions

Climate Action

- Greenhouse Gas Emissions Targets [1]
- Emissions Caps for Electricity [2]
- Climate Action Plans [3]
- Climate Change Commissions and Advisory Groups [4]
- Regional Initiatives [5]
- GHG Reporting and Registries [6]
- State Adaptation Plans [7]

Energy Sector

- Public Benefit Funds [8]
- Renewable & Alternative Energy Portfolio Standards [9]
- Net Metering Programs [10]
- Green Pricing Programs [11]
- Decoupling Policies [12]
- Renewable Energy Credit Tracking Systems [13]
- Energy Efficiency Resource Standards [14]
- Financial Incentives for CCS [15]

Transportation Sector

- Vehicle GHG Emissions Standards [16]
- Mandates and Incentives Promoting Biofuels [17]
- VMT-Related Policies and Incentives [18]
- Low Carbon Fuel Standard [19]
- Medium- and Heavy-Duty Vehicle Policies [20]
- Plug-in Electric Vehicles [21]

Building Sector

- Residential Building Energy Codes [22]
- Commercial Building Energy Codes [23]
- Green Building Standards for State Buildings [24]
- Appliance Efficiency Standards [25]
- Property Assessed Clean Energy (PACE) Programs [26]

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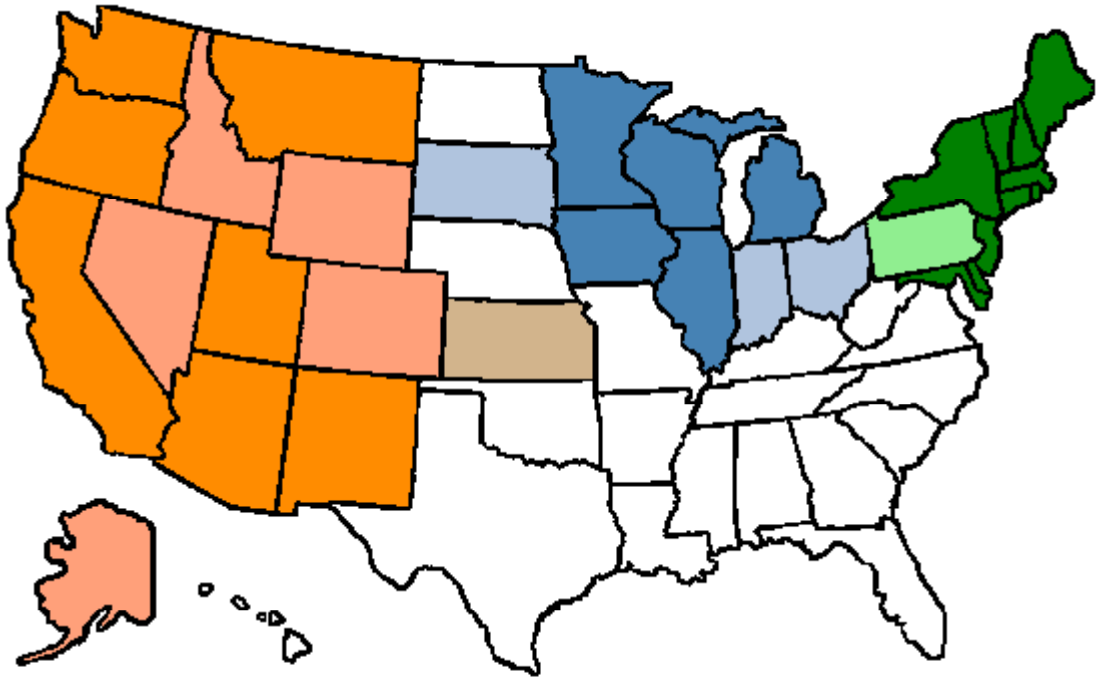
REGION/STATE CLIMATE POLICIES



- Regional Greenhouse Gas Initiative & TCI
- RGGI Observer & TCI
- Midwest GHG Reduction Accord
- MGGRA Observer
- Western Climate Initiative
- Western Climate Initiative Observer
- WCI Observer & MGGRA

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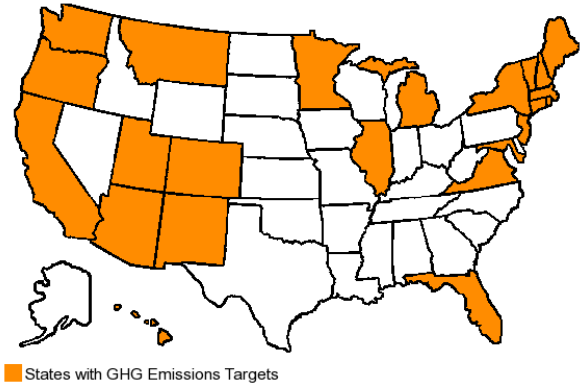
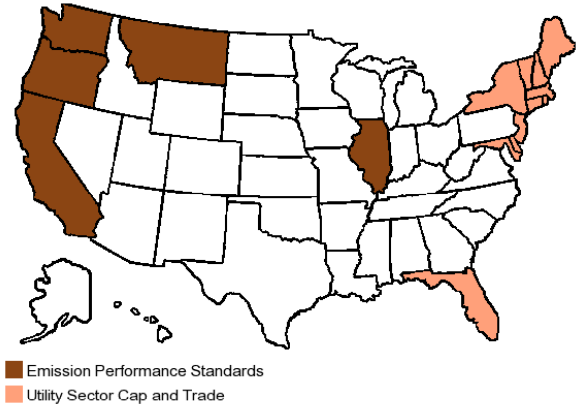
STATE CLIMATE POLICIES

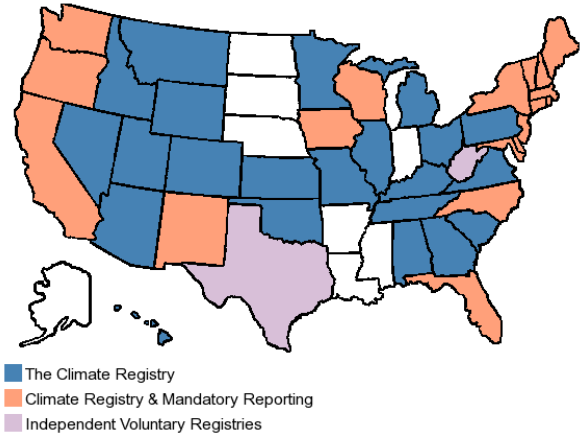


GHG Emissions Targets

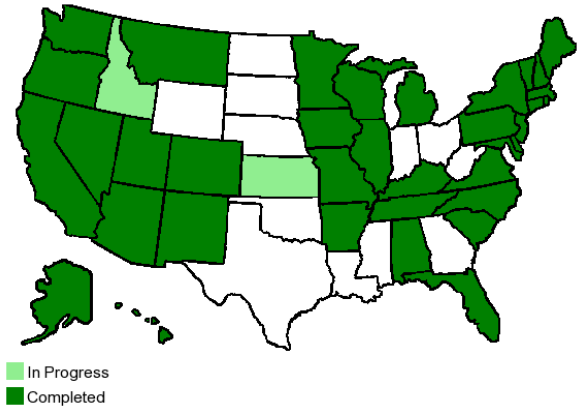
States With:



Emissions Caps for Electricity



GHG Reporting & Registries



Climate Action Plans

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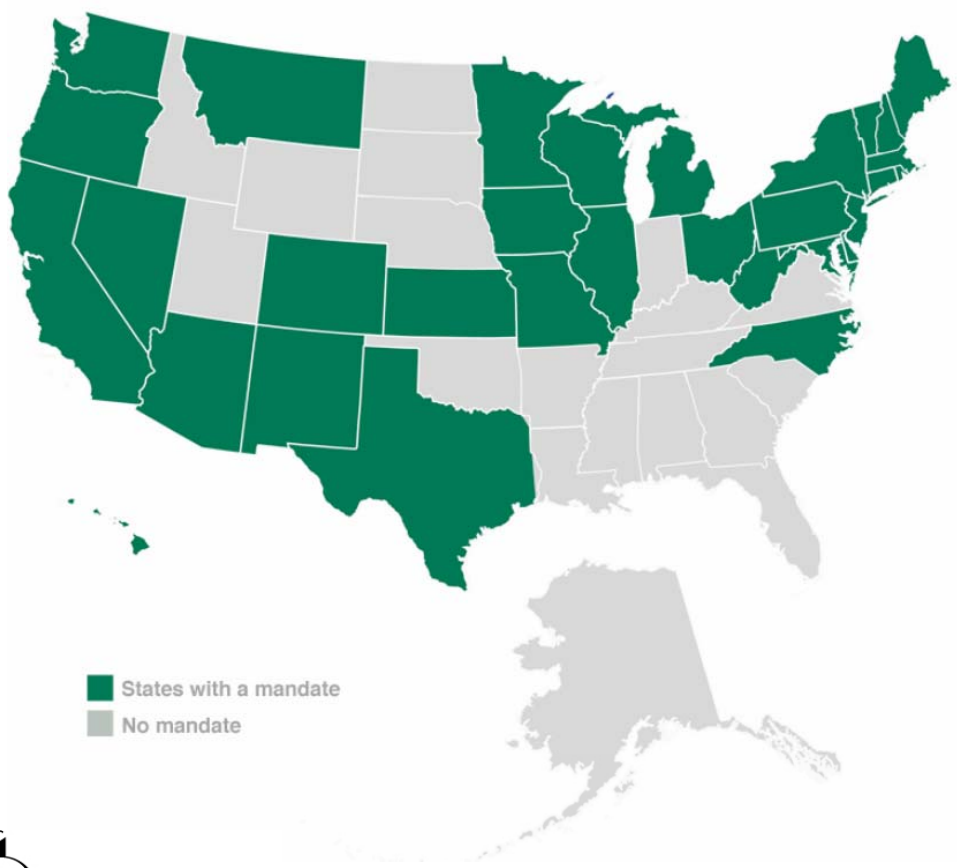
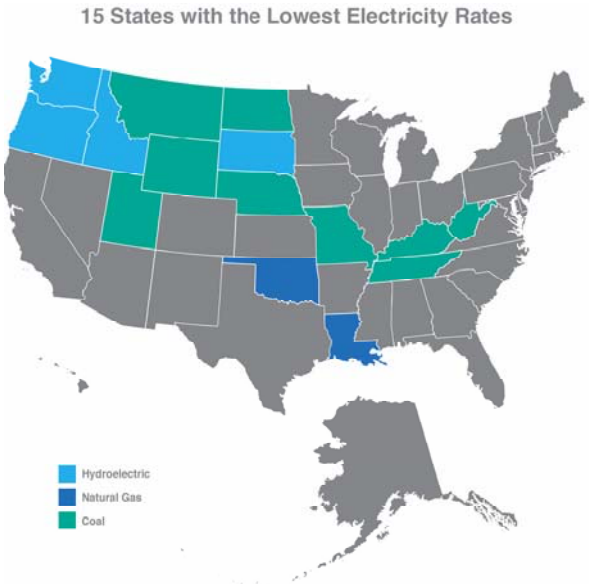
STATE CLIMATE POLICIES

States With Renewable Energy Mandates



- Only 14 of 36 states are meeting or on track to meet goals
- 18 states are not on track to meet their goals
- 4 states have not implemented their mandate or do not yet have data



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IER INSTITUTE FOR ENERGY RESEARCH

STATE CLIMATE POLICIES

	Climate Action							Energy Sector								Transportation		Building Sector				
State	Regional Initiatives	Climate Action Plan Completed or in Progress	Climate Change Commissions and Advisory Groups	GHG Targets	GHG Inventory	GHG registry	State Adaptation Plan	Carbon capt/offset for power plants	Public Benefit Fund	Renewable Portfolio Standard	Net Metering	Green Pricing	REC Tracking System	Energy Efficiency Resource Standard	State Government Purchasing Green Power	Vehicle GHG Standards	Mandates and Incentives Promoting Biofuels	Green Building Standards for State Buildings	Appliance Efficiency Standards	Residential Building Energy Codes	Commercial Building Energy Codes	Total
AK	✓	✓	✓				✓										✓			✓		6
AL					✓	✓						✓						✓				4
AR		✓	✓				✓				✓						✓	✓		✓	✓	8
AZ	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓			16
CA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	21
CO	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓				15
CT	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	19
DC									✓	✓	✓	✓						✓		✓	✓	7
DE	✓	✓			✓	✓			✓	✓	✓	✓								✓	✓	10
FL		✓	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	✓	15
GA					✓	✓					✓	✓						✓		✓	✓	7
HI		✓		✓	✓	✓			✓	✓	✓	✓		✓	✓		✓	✓		✓	✓	14
IA	✓	✓	✓		✓	✓				✓	✓	✓	✓		✓		✓			✓		12
ID	✓	✓			✓	✓					✓	✓	✓				✓			✓	✓	10
IL	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓					14
IN	✓				✓						✓	✓			✓		✓	✓		✓	✓	9
KS	✓	✓	✓		✓	✓											✓			✓	✓	8
KY		✓			✓						✓	✓					✓			✓	✓	7
LA					✓						✓	✓					✓	✓			✓	6
MA	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	19
MD	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			16
ME	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	15
MN	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓			✓			✓	✓	15
MI	✓	✓			✓	✓			✓	✓	✓	✓		✓			✓	✓				11
MO		✓			✓	✓				✓	✓	✓					✓					7
MS					✓							✓					✓					3
MT	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓				✓			✓	✓	13
NC		✓	✓		✓	✓	✓			✓	✓	✓		✓			✓			✓	✓	12
ND											✓	✓	✓				✓			✓	✓	6
NE									✓		✓	✓								✓	✓	5
NH	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓							✓	✓	13
NJ	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	17
NM	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	17
NV	✓	✓	✓		✓	✓			✓	✓	✓		✓	✓				✓		✓	✓	13
NY	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	18
OH	✓				✓	✓			✓		✓	✓		✓			✓	✓		✓	✓	11
OK					✓	✓					✓	✓					✓	✓		✓		7
OR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	10
PA	✓	✓			✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	16
RI	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	17
SC		✓	✓			✓	✓				✓	✓					✓	✓		✓	✓	10
SD	✓											✓	✓				✓	✓				5
TN					✓	✓						✓								✓		4
TX					✓	✓			✓	✓	✓	✓	✓	✓			✓			✓	✓	11
UT	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓		✓	✓	✓			✓	✓	15
VA		✓	✓	✓	✓	✓					✓	✓	✓				✓	✓		✓	✓	12
VT	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	17
WA	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	19
WI	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	15
WV					✓	✓					✓		✓							✓	✓	6
WY	✓					✓					✓	✓	✓				✓					6
Total	32	36	23	20	43	41	15	5	25	29	45	45	29	21	17	17	39	29	12	38	37	

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version 1/27/2009

OTHER CLIMATE-RELATED ACTIVITIES

What else we might expect to see this year:

- Litigation of EPA's endangerment finding (underpins EPA authority to regulate GHGs)
- Litigation of EPA's GHG auto/truck emissions standards
- Litigation of EPA's tailoring rules (PSD and Title V GHG permits)
- Greater scrutiny/investigation of IPCC climate science/reports
- Retrenchment of some state's climate programs
- *Maybe* an energy bill addressing "all of the above" energy sources.

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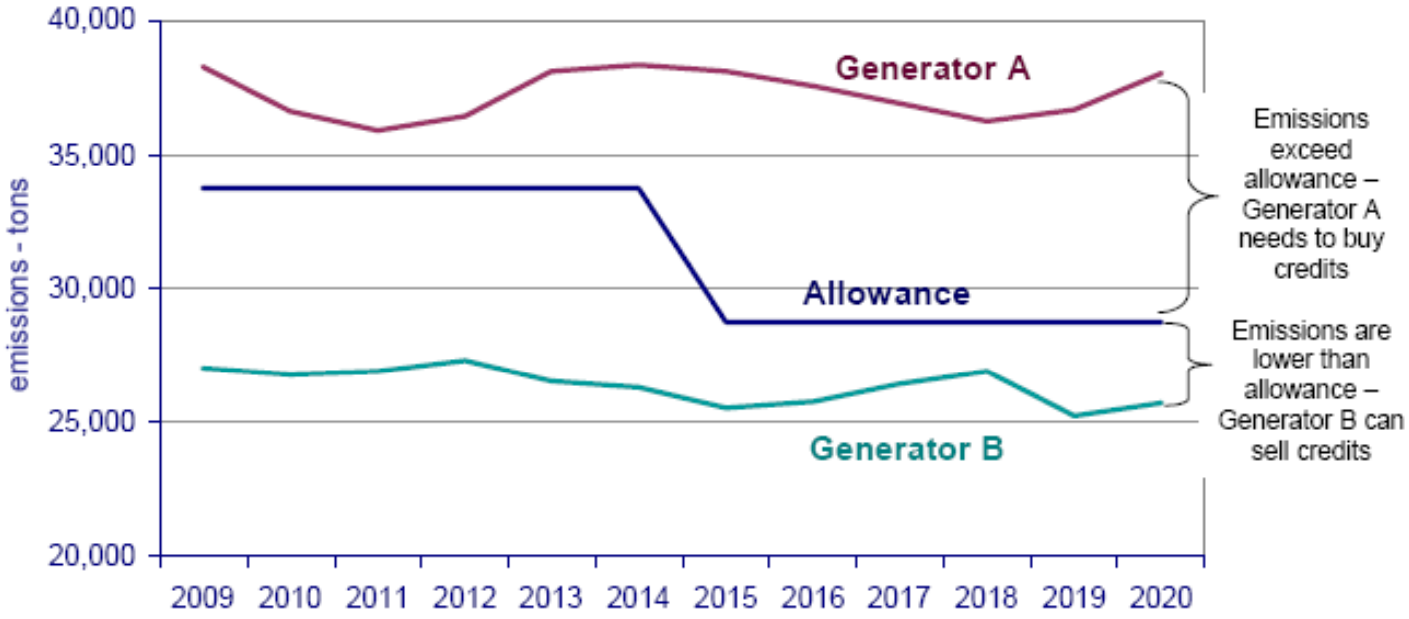
MITIGATION TECHNOLOGIES
CAP-AND-TRADE

Cap–and–Trade Basics



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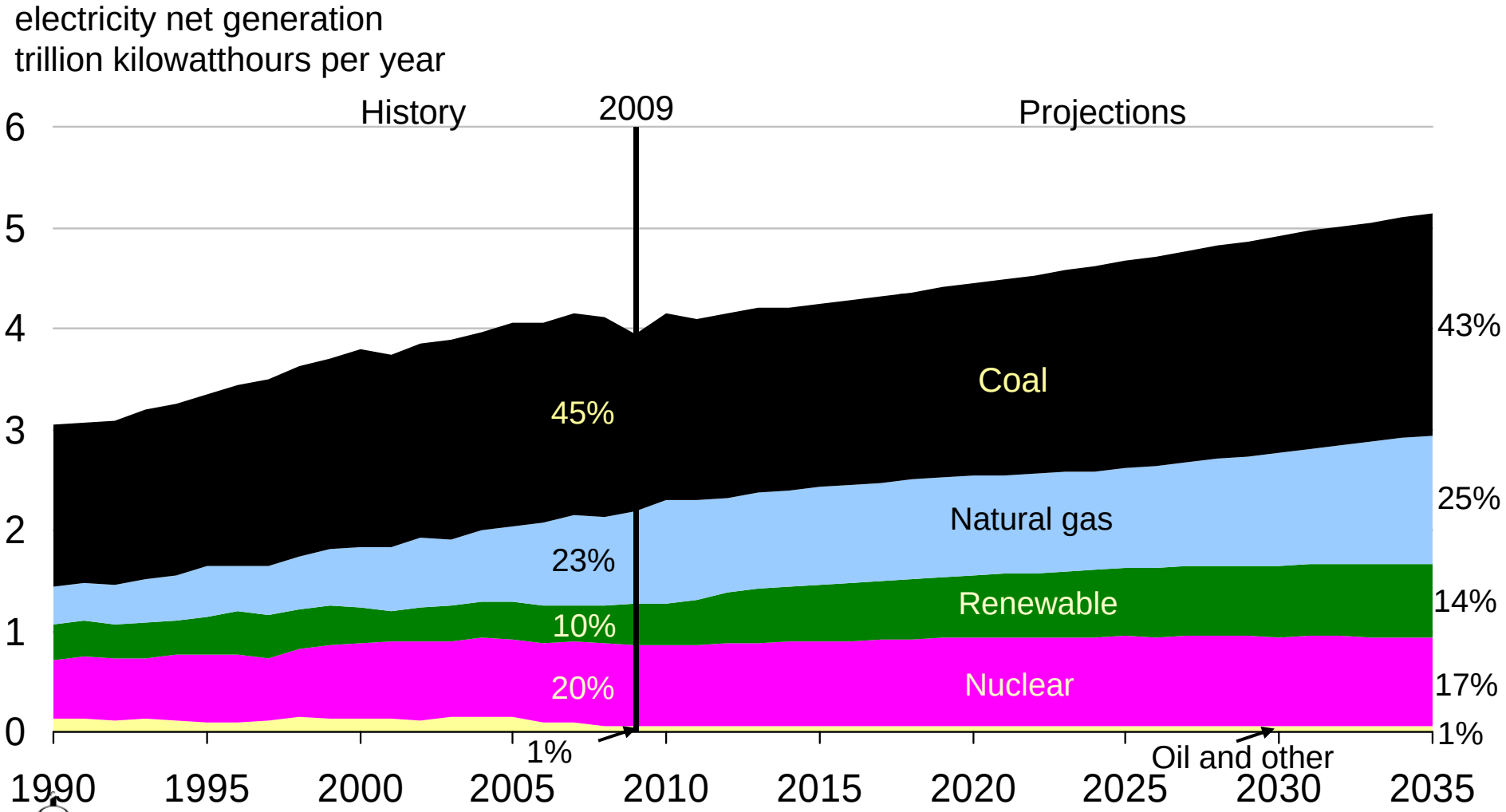
MITIGATION TECHNOLOGIES

The projected electricity mix gradually shifts to lower-carbon options, with generation from natural gas rising 37% and renewables rising 73%



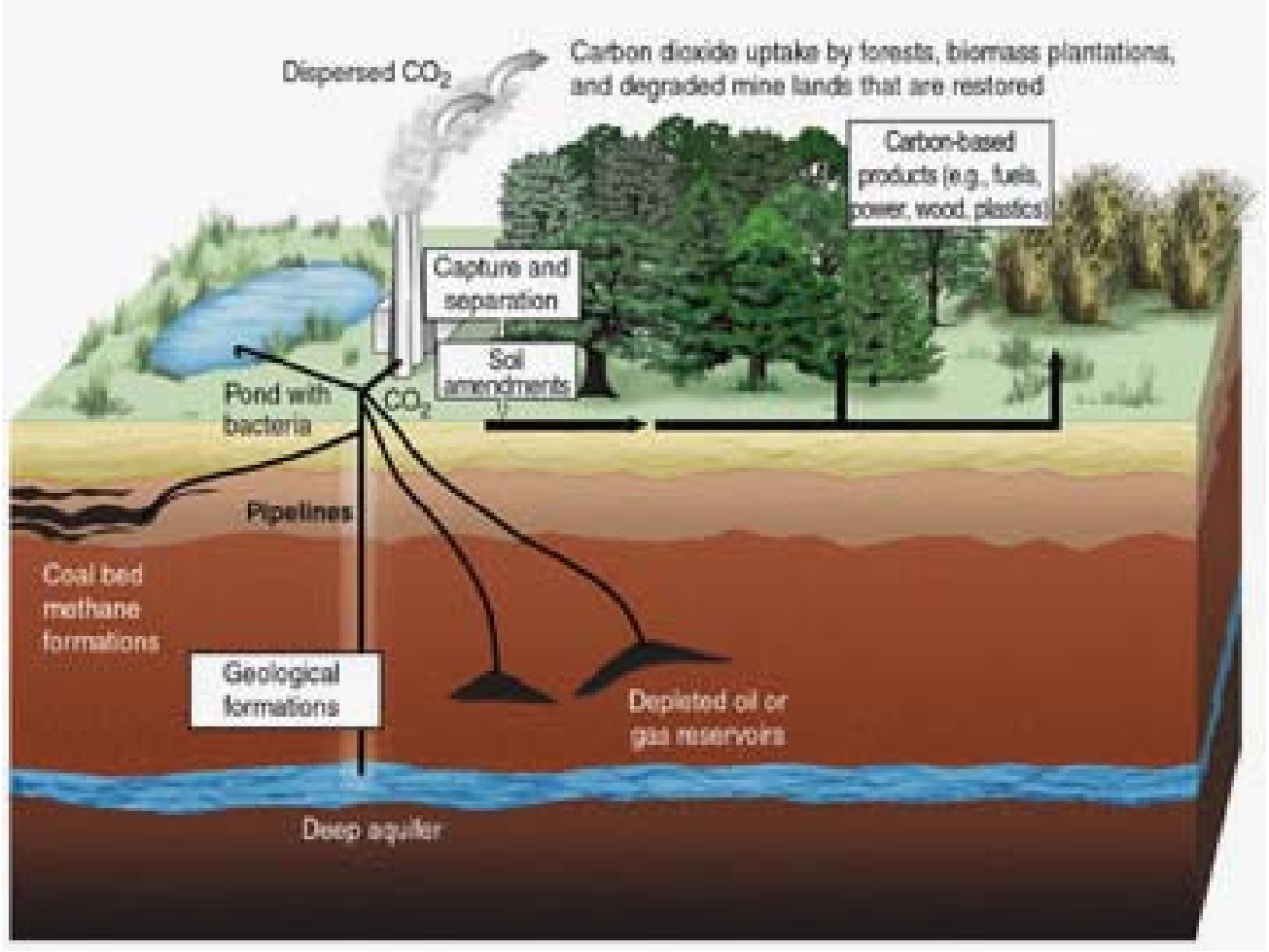
It is projected that 50 – 65 GW of coal plant generating capacity may be lost by 2020 due to EPA environmental regulations.

Source: EIA, *Annual Energy Outlook 2011*

MITIGATION TECHNOLOGIES

Carbon Capture and Storage

Geosequestration - Biosequestration



Source: www.123eng.com/projects/carbon.doc

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MITIGATION TECHNOLOGIES

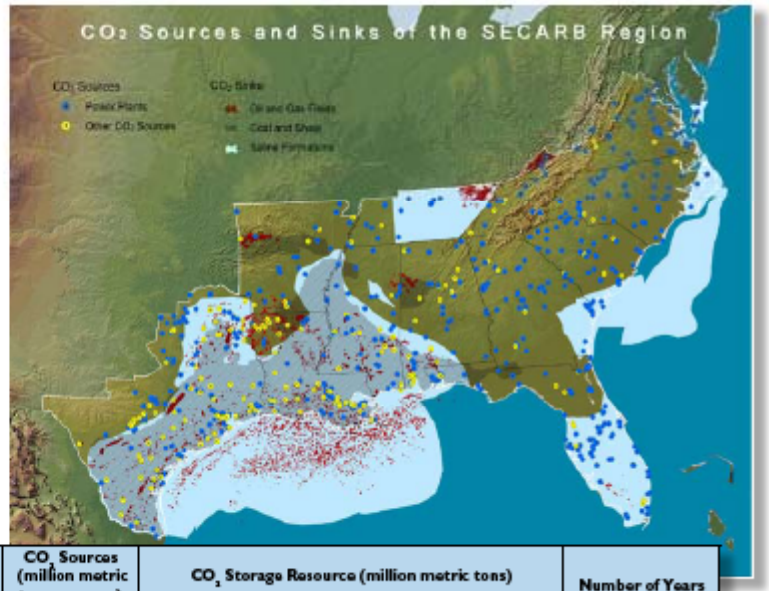
Southeast Regional Carbon Sequestration Partnership (SECARB)

SECARB: Composite Map of CO_2 Sources and Geologic Storage Formations

The distance between a CO_2 stationary source and a geologic storage formation is calculated as the shortest straight-line distance from each source to the nearest geologic storage site. While these results do not give a complete picture of the transportation and infrastructure requirements, they do give a first-order interpretation of the magnitude of the requirements.

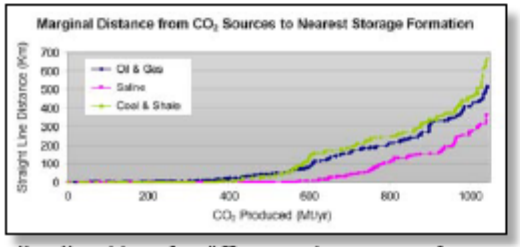
The sources in SECARB match up well with the potential storage reservoirs. For example, more than 70 percent of all sources (by volume) in the SECARB Region are located within 50 km (31 mi) of a storage formation. Approximately 40 percent of the sources are actually co-located with an appropriate storage formation. This especially occurs in the Gulf Coast region where many of the sources overlie saline formations, coal beds, or both.

The table below identifies how many years storage is possible given the current annual emissions and the known CO_2 storage resource.



Formation Type	Straight-Line Distance to Nearest Formation		
	< 50 km	50 -100 km	> 100 km
Oil and Gas Fields	50%	9%	42%
Saline Formations	71%	5%	25%
Coal and Shale	52%	4%	44%
All Reservoirs	76%	5%	19%

Note: The total annual CO_2 storage rate used was 938 million metric tons, which was estimated based on current emissions and assuming 90% capture efficiency.



Above: Marginal distance from all CO_2 sources to their nearest storage formation.

State	CO_2 Sources (million metric tons per year)	CO_2 Storage Resource (million metric tons)				Number of Years Storage **
	Total	Oil and Gas	Coal and Shale*	Saline*	Total	
AL	79	390	2,592	32,250	35,232	446
AR	35	372	16,200	23,623	40,195	1,148
FL	143	183	1,700	28,950	30,833	216
GA	90	—	—	3,068	3,068	34
LA	102	7,960	11,100	348,744	367,804	3,606
MS	34	579	7,200	116,068	123,847	3,643
NC	77	—	—	3,380	3,380	44
SC	40	—	—	1,247	1,247	31
TN	66	—	—	1,250	1,250	19
TX****	333	6,332	18,700	513,870	538,902	1,618
VA	47	10	308	398	716	15
Federal Offshore	—	18,860	—	1,201,741	1,220,741	N/A
TOTAL	1,045	34,686	57,800	2,274,589	2,367,215	2,263***

* Low estimates used
** Years of CO_2 Storage at the current emission rates (State CO_2 storage resource/ state annual emissions)
*** Average years storage for whole of SECARB area (Total CO_2 storage resource/ total annual emissions)
**** Eastern Texas: TRRC Districts 1-6

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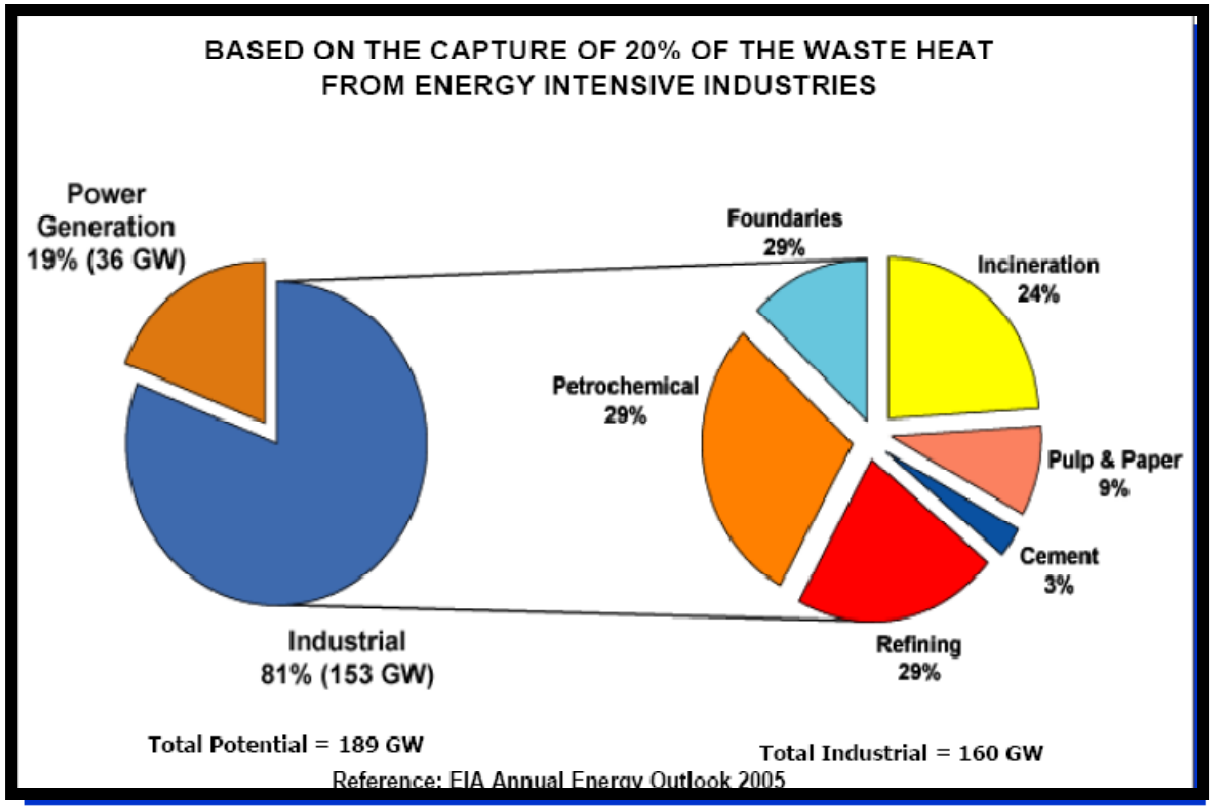
MITIGATION TECHNOLOGIES

Waste-to-Energy: Waste Heat Recovery



With Louisiana's energy intensive industries, there should be good energy potential from waste heat recovery.

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MITIGATION TECHNOLOGIES

Waste-to-Energy: Waste Heat Recovery

BROAD CHP

Fort Bragg Airforce Base, USA (Exhaust) — **Military Base**

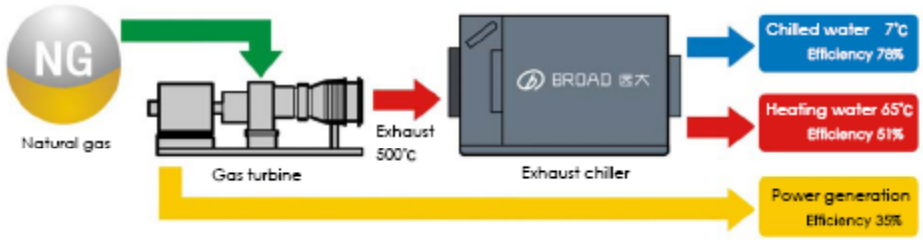
Power generator produces electricity and supplies to buildings or Power Grid, BROAD chiller recycles exhaust for cooling & heating, no fuel input.

Cooling capacity: 992 Rt/3.5 MW
Energy input: exhaust
Power generator: 5.2 MW
Energy efficiency: 113% (electricity + cooling)
Power generation efficiency: 35%

Yearly energy saving cost: USD 0.27 million
Payback period: 4 years
Yearly CO_2 cutting: 2,500 ton
Equivalent of planting 0.14 million trees

US military base of the 82nd Airborne Division

Mode 1: Exhaust type **Energy efficiency:** **Electricity + cooling 113%** **Electricity + heating 86%**



*Non-electric refrigeration

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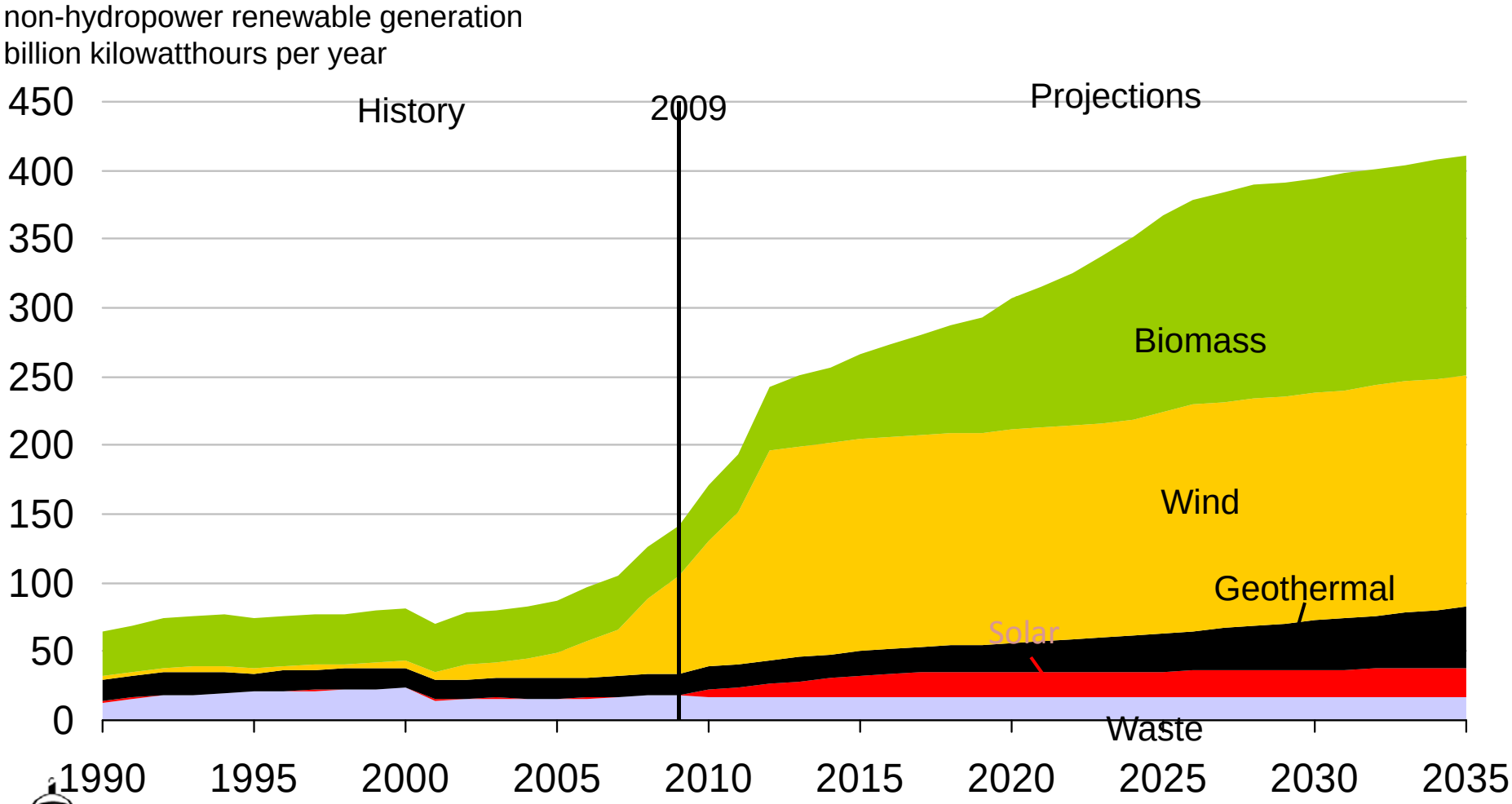
Non-hydro renewable sources grow nearly three-fold, meeting 23% of projected electricity generation growth



Source: EIA, *Annual Energy Outlook 2011*

MITIGATION TECHNOLOGIES

Louisiana Renewable Energy Resources

- Hydroelectric (Sabine River Authority, Louisiana Hydroelectric)
- Hydrokinetic (Mississippi River possibilities)
- Wave
- Tide
- Ocean Thermal Energy Conversion (OTEC) – Some GOM potential
- Geothermal – Some potential for direct heat along AR and TX borders
- * Geopressured-Geothermal (Good potential LA and TX)
- Solar – some potential (2007 LA solar tax credit bill)
- Wind – some potential along coast (LA authorizes lease of state-owned lands for wind power production)
- Biomass – good potential (forest residues, mill residues, agricultural residues, urban wood wastes, e.g. bark, wood chips, bagasse, rice hulls)
- Biogas – landfills, anaerobic digestors
- Biofuels – good potential (grain/sugar ethanol, biodiesel, cellulosic ethanol, green diesel and gasoline, butanol, diesel/jet fuel from algae, pyrolysis liquids, syngas liquids)

* USGS EST 5,700 QUAD btu RECOVERABLE GAS AND 11,000 QUADS THERMAL ENERGY IN ONSHORE GULF COAST RESERVOIRS. U.S. USES 100 QUADS/YR

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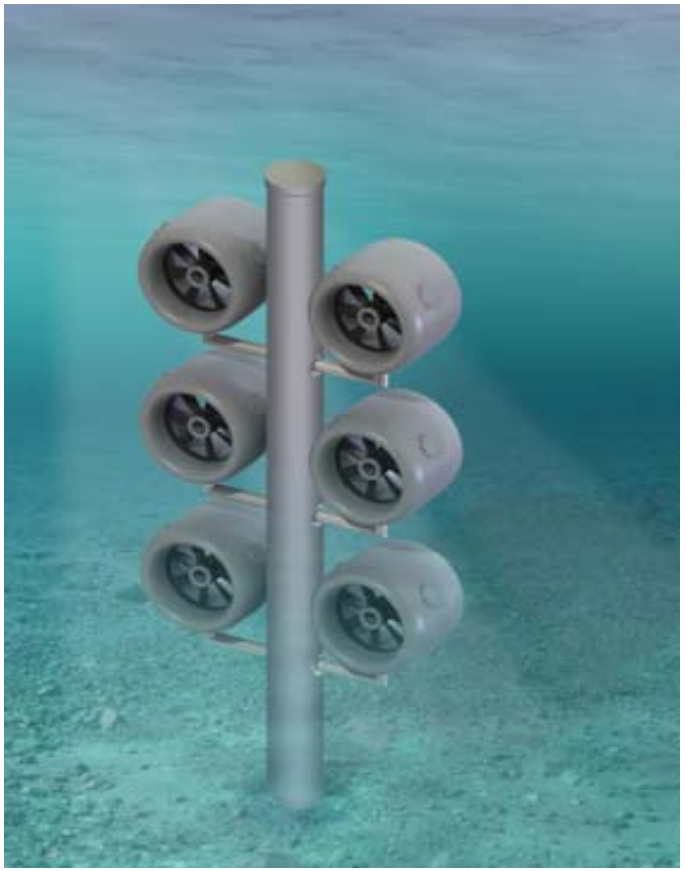
Renewable Energy: Hydrokinetic

*Being considered for the Mississippi River

- Typical installation includes six turbines
- Mounted on piling below shipping traffic



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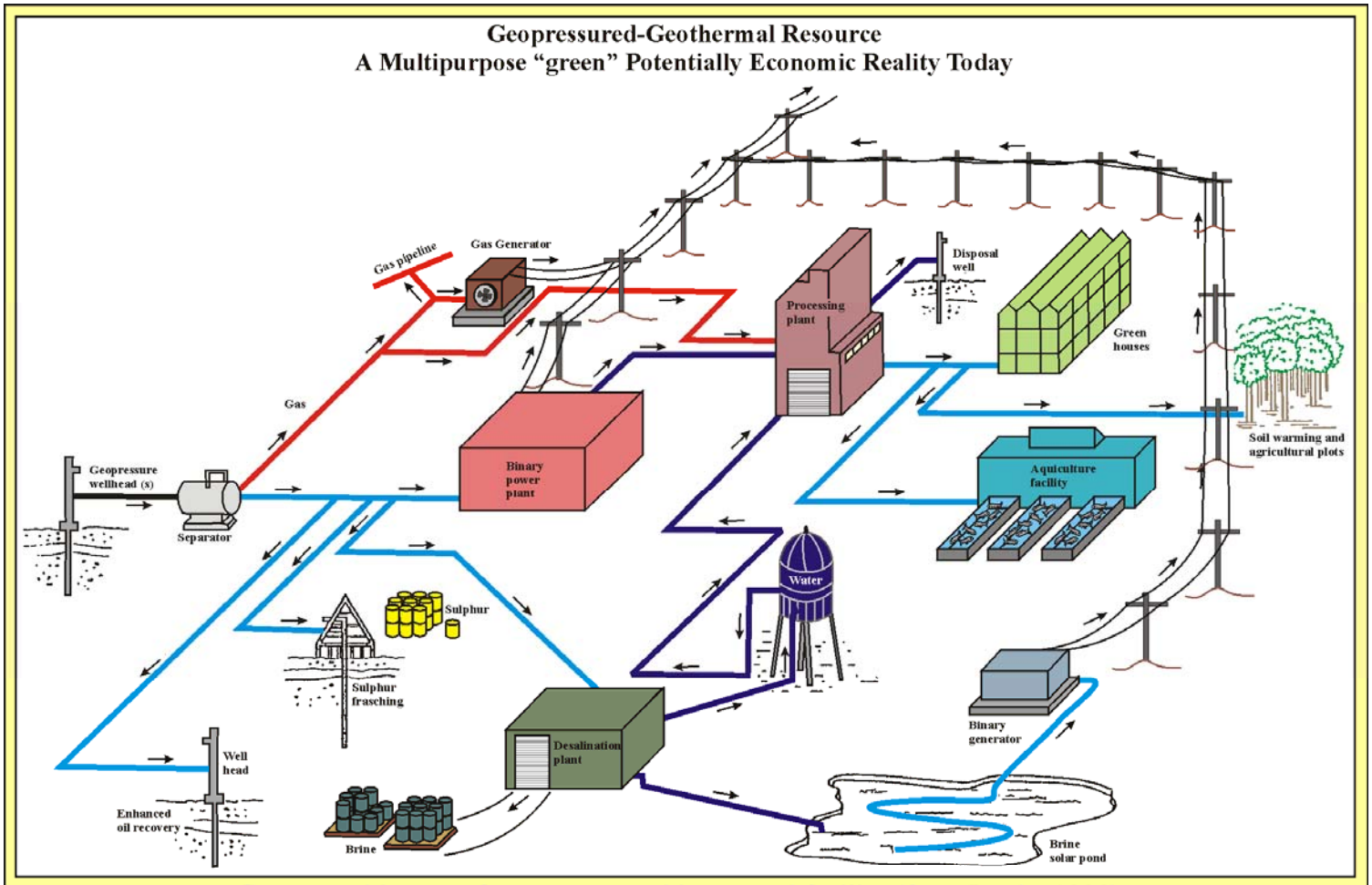
Renewable Energy : Geopressured Geothermal



Conceptual layout of a geopressured integrated facility (from Lunis, 1990).

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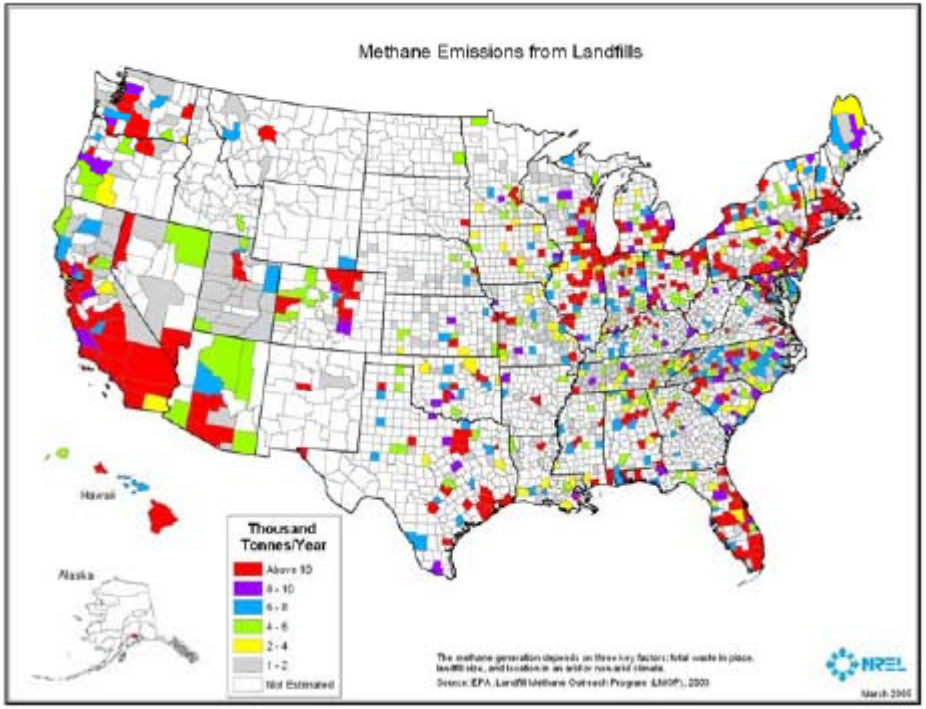
Renewable Energy : Biogas

Methane from Landfills



- Three active landfill methane projects in LA.
- Resource availability for Louisiana estimated at 166,000 tons methane per year (NREL, 2005)

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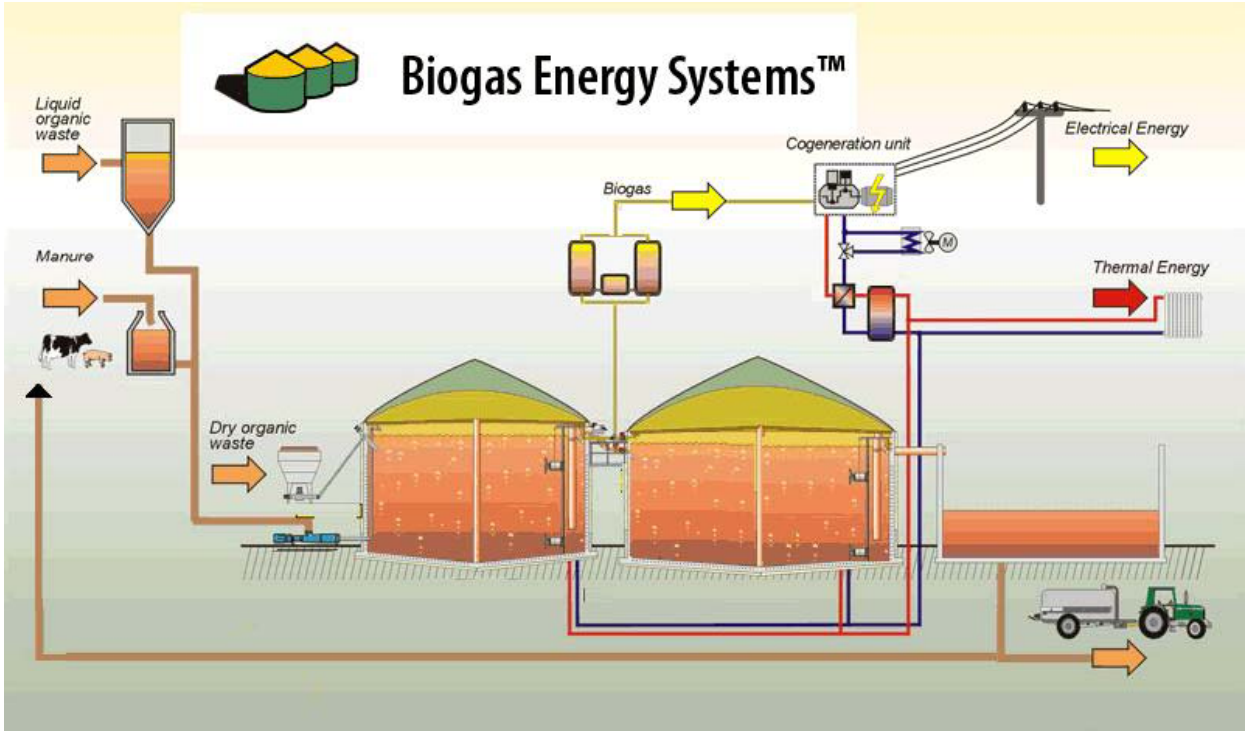
Renewable Energy: Biogas

Anaerobic Digestion



- DOE (1998) found that it is feasible to capture and use over a third of biogas potential from landfills, animal waste, and sewage or about 1.25 quadrillion Btu (about 6% of all natural gas used in the U.S).
- In Sweden, biogas from organic wastes fuels city buses, garbage trucks, taxi cabs, even a train.
- Over 4,000 anaerobic digesters have been built in Germany.
- A new generation of AD has been developed in the UK to help solve the problem of shortage of landfill sites.

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Louisiana's Bioenergy Resources

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BIOENERGY

Woody Biomass Fuels – Fuel Pellets

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Themochemical Conversion of Biomass

- Thermochemical conversion technologies (TCT) convert biomass to fuels, chemicals, and power using gasification and pyrolysis techniques. The TCT route for biofuel production is largely based on existing technologies that have been in operation for a number of decades.
- Gasification involves heating biomass with about one-third of the oxygen necessary for complete combustion to produce a mixture of carbon monoxide and hydrogen, known as syngas.
- A typical biomass-to-liquids (BTL) process would involve the production of a syngas which is cleaned before being passed through the Fischer-Tropsch process to create a range of liquid fuels suitable for aviation and marine applications, but mainly synthetic diesel.
- Pyrolysis involves heating the biomass in the absence of oxygen to produce a liquid pyrolysis oil that can be refined to produce various fuels and chemicals.
- A principle advantage of TCT is the wide variety of feedstocks that can be used to produce any number of specific fuels or chemicals.
- A principle disadvantage is cost.

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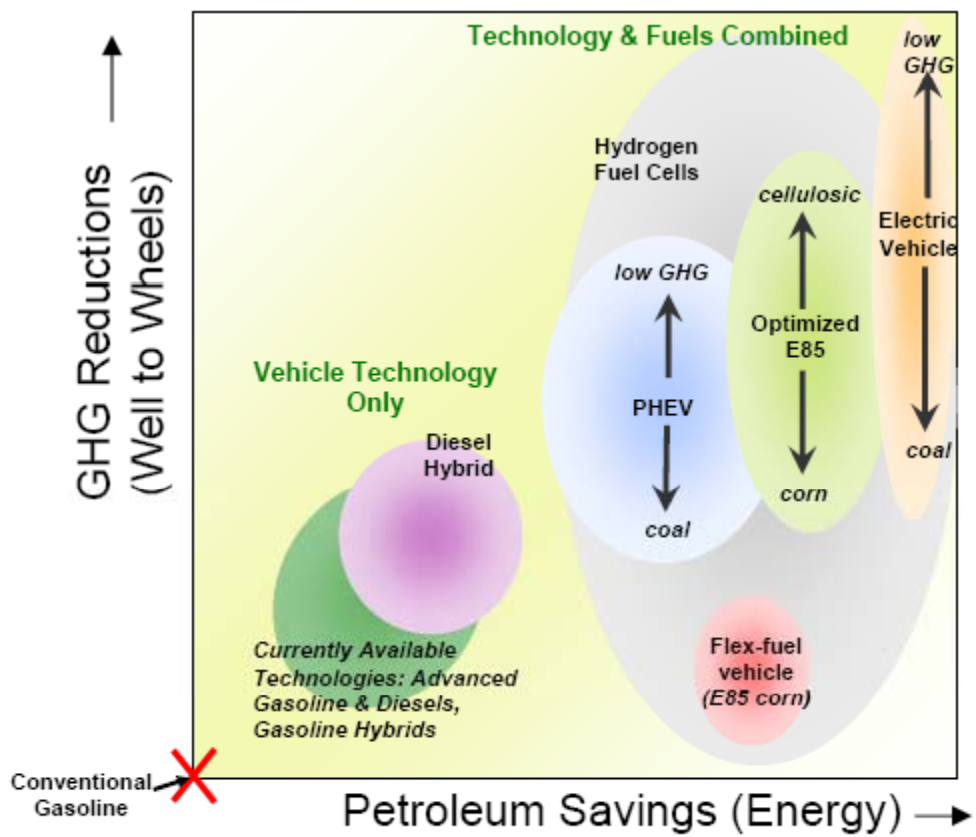
Transportation: Alternative Fuels/Vehicle Technologies



Project Better Place
Denmark

Illustrative example of GHG reductions and petroleum savings for (1) various technology-only approaches and (2) combinations of vehicle technologies with alternative fuels. The reductions relative to today's conventional gasoline vehicle are shown. Note that the size and position of the bubbles are illustrative and assumptions-driven. Source: EPA

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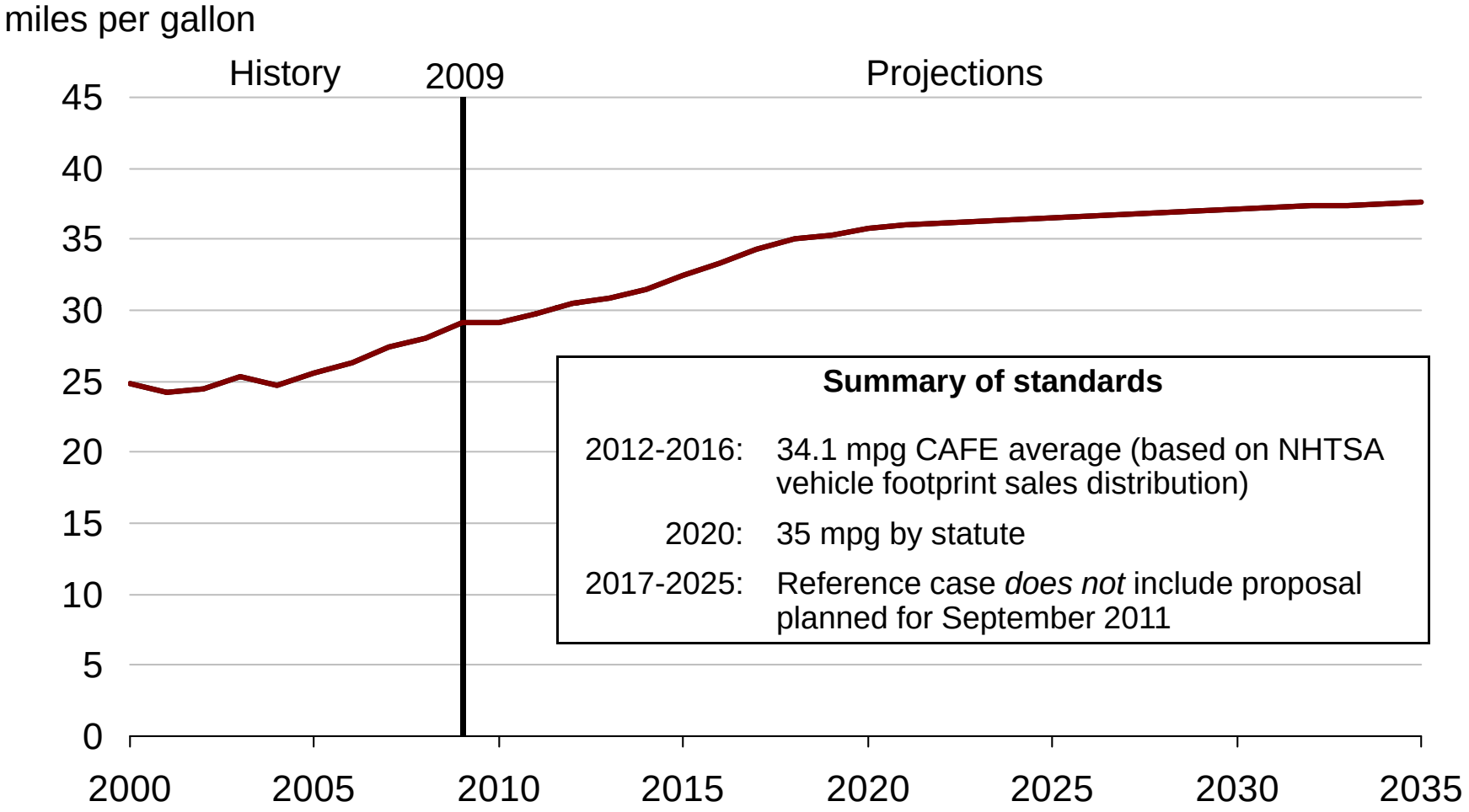
New light duty vehicle fuel economy achieves almost 38 mpg by 2035 in the Reference case



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Source: EIA, *Annual Energy Outlook 2011*

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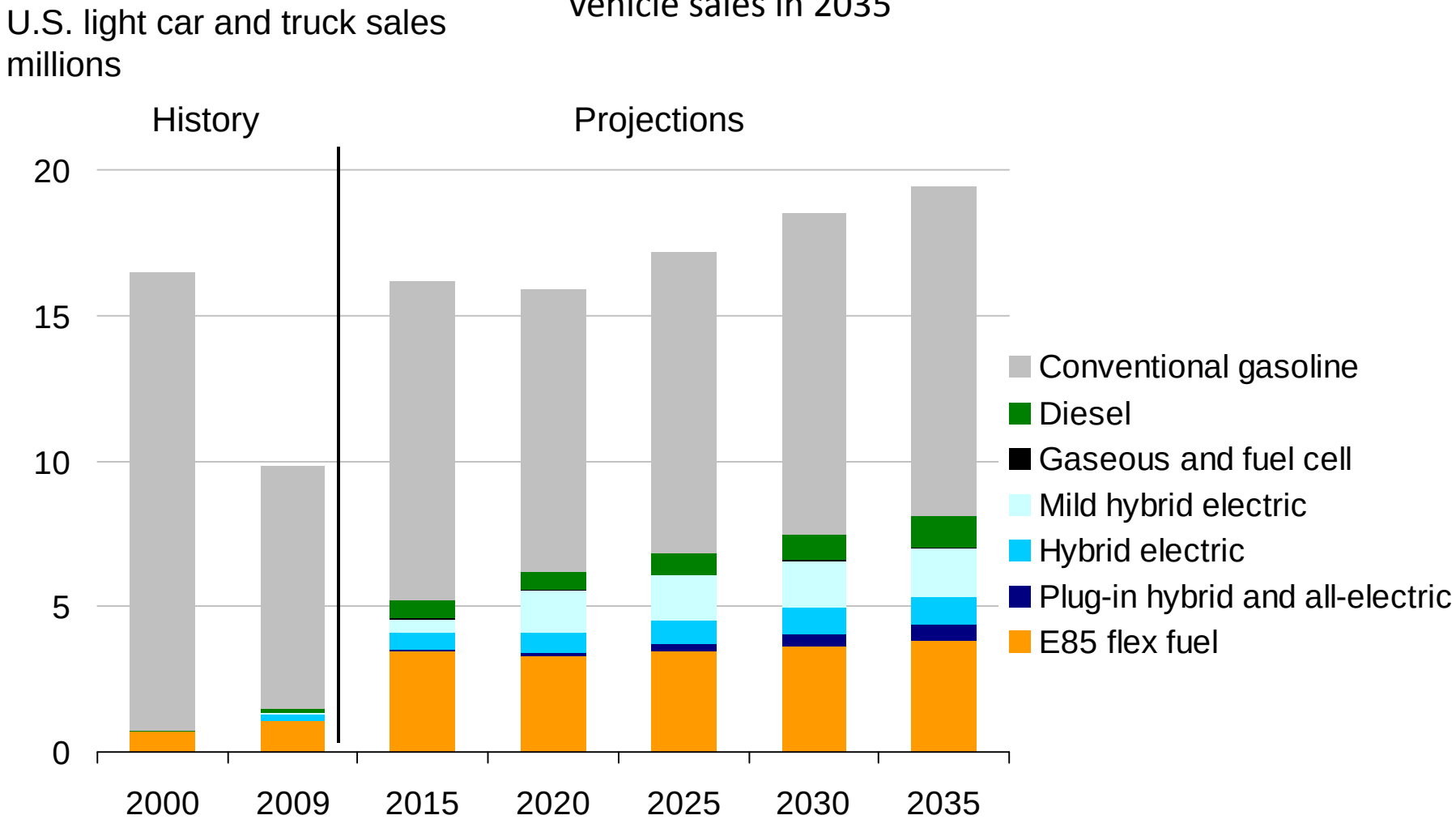
Unconventional vehicles meet over 40% of U.S. light-duty vehicle sales in 2035



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Source: EIA, *Annual Energy Outlook 2011*

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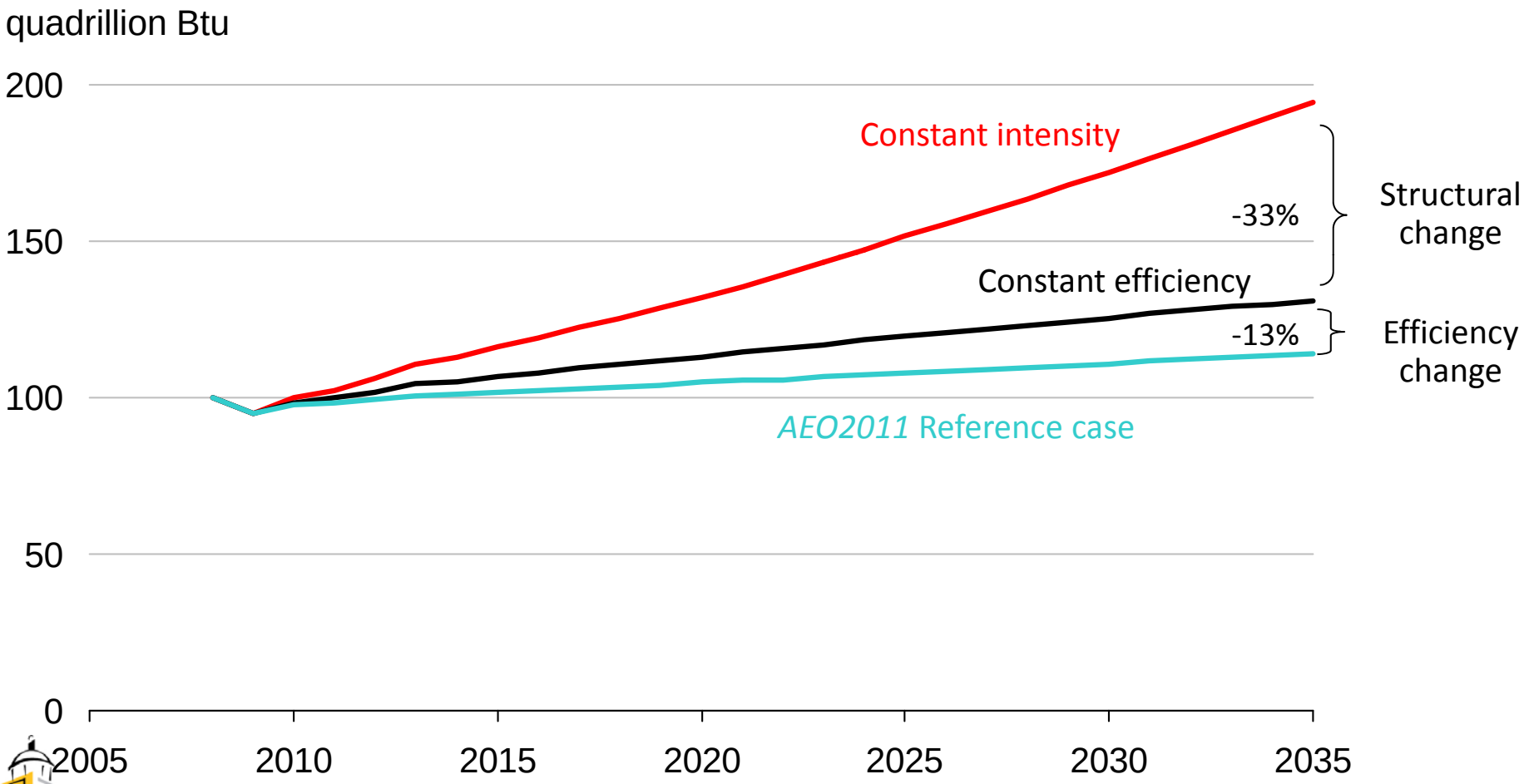
Energy efficiency gains reduce consumption 13% from where it would otherwise be; structural change is even larger



Source: EIA, *Annual Energy Outlook 2011*

QUESTIONS/DISCUSSION

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