The 2030 Blueprint

Solving Climate Change Saves Billions

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Introduction

Faced with the daunting crisis of global warming, the U.S. is struggling to find a solution while preserving the energy status quo. This approach will not work. As the following analysis illustrates, a new approach is needed that both avoids dangerous climate change and is advantageous for the U.S. economy. The implementation of the 2030 Blueprint proposed below will dramatically reduce U.S. greenhouse gas emissions and simultaneously provide a much-needed stimulus to the U.S. economy.

According to Dr. James Hansen's et al. recent paper, titled *Target CO_2: Where Should Humanity Aim?* (http://www.columbia.edu/~jeh1/2008/TargetCO2_20080317.pdf), the bar for acceptable levels of CO_2 (the major greenhouse gas) in the atmosphere should be lowered to 350ppm, possibly lower, if we are to avert catastrophic climate change. We are currently at 385ppm and increasing at about 2ppm annually.

Many times, complex problems require the simplest of solutions. One of the most important questions facing those attempting to solve the climate change crisis is, "How do we reduce CO_2 emissions dramatically and immediately?" The simplest answer is, "Turn off the coal plants."

Although coal produces about half of the energy supplied by the Electric Power Sector, it is responsible for 81% of this sector's CO_2 emissions. According to *Target CO_2*, if we are to have any chance of averting a climatic catastrophe, we must implement an immediate moratorium on the construction of any new conventional coal-fired power plants and complete a phasing out of all existing conventional coal plants by the year 2030. Anything short of this will fail.

Not surprisingly, because of the many vested interests in the coal industry (existing infrastructure, jobs and large U.S. coal reserves), it is difficult for some to let go of a 'sure thing,' even when faced with a planetary crisis. Although the coal industry has offered up 'clean' coal, i.e., coal with carbon capture and sequestration (CCS), as a fix for the offending CO_2 emissions of conventional coal plants, this 'solution' cannot be implemented in time to avert dangerous climate change. According to scientists, the world has seven years to reverse its current CO_2 trend[1]. The coal industry itself has acknowledged that, if it can be proven possible and economically feasible, implementing CCS technology is 20 years out[2].

The economic feasibility of any proposed actions regarding climate change is a particularly important consideration in this time of looming recession. Therefore, this study is an investigation not only of the most effective actions that can be taken in addressing climate change, but also of the implications of these actions on the US economy.

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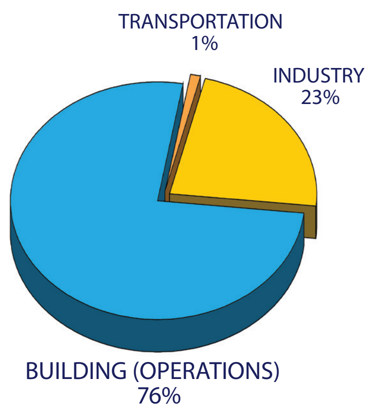
1 Source: Washington Post, November 18, 2007, *Emissions Growth Must End in 7 Years, UN Warns* (http://www.washingtonpost.com/wp-dyn/content/article/2007/11/17/AR2007111700566 html?hpid=moreheadlines). To read the conclusions of IPCC's fourth complete report, go to: http://www.ipcc.ch/

2 Zakaria, F., *Cathedral Thinking*, Newsweek, August, 2007 (http://www.duke-energy.com/pdfs/Newsweek_14952.pdf)

The Biggest Bang for the Buck: Cost vs. Benefit

To 'turn off the coal plants', one must replace conventional coal plants with another energy source and/or eliminate the demand for the energy produced by these plants. The following analysis compares the effectiveness, costs and benefits of three very different energy resource approaches to the climate change crisis: energy efficiency in buildings, 'clean' coal, and nuclear power.

As stated above, coal is responsible for 81% of the CO_2 emissions from the Electric Power Sector. Because 76% of all electricity generated by power plants in the U.S. is used to operate buildings[3], it is necessary to consider the impact of energy efficiency in buildings as a viable strategy in addressing global warming.



U.S. ELECTRICITY CONSUMPTION

Today, of the approximately 38.5 QBtu[4] of primary energy consumed by residential and commercial building operations in the U.S. each year, 27.3 QBtu is consumed in the form of electricity. About 14.2 QBtu of this electricity is produced by conventional coal-fired power plants[5]. According to a recent McKinsey Global Institute report[6] (February, 2008), the implementation of just straightforward, off-the-shelf, residential and commercial building efficiency measures would reduce energy consumption by 11.1 QBtu for an investment of $21.6 billion per QBtu[7].

Investment in building energy efficiency is surprisingly effective. A single investment of $21.6 billion would replace 22.3 conventional 500 MW coal-fired power plants, reduce annual CO_2 emissions by 86.7 million metric tons, save 204 billion cu. ft. of natural gas and 10.7 million barrels of oil each year[8], save consumers $8.46 billion in energy bills annually[9] (less than a 3-year simple payback) and create 216,000 permanent new jobs[10].

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3 Source: Energy Information Administration statistics, combining building operations electricity consumption in the residential, commercial and industrial sectors.

4 Primary Energy is the total energy consumed by an end-user, including the energy used in the generation and transmission of electricity.

5 Source: Energy Information Administration. Total 2004 primary electricity consumption for residential and commercial buildings is 27.3 QBtu, with 52% of that amount produced by coal-fired power plants, or 14.2 QBtu.

6 Farrell, D., et al., The Case for Investing in Energy Productivity, McKinsey Global Institute, February, 2008.

7 According to the February, 2008 McKinsey study cited above, there are 7.1 QBtu of residential Building Sector primary energy reduction opportunities at $17.6 billion/QBtu, and 4.0 QBtu of commercial Building Sector reduction opportunities at $26.0 billion/QBtu, or the average for residential and commercial building sector reduction opportunities is $20.6 billion/QBtu. To be conservative, we used a figure of $21.6 billion/QBtu for this study. The 11.1 QBtu total energy reduction opportunity is assumed to take place over a 12 year period.

8 One primary Quad (QBtu) of energy consumed in the Building Sector is equal to: i) the energy produced (including losses) by 22.3 conventional coal-fired power plants (.71 QBtu), plus ii) the 204 billion cu. ft. of natural gas and 10.7 million barrels of oil consumed directly in buildings (.29 QBtu).

9 Source: Department of Energy, 2006 Buildings Energy Data Book.

10 This job figure assumes that each $100,000 of investment in building energy efficiency will create one permanent job. This is a conservative figure. A report analyzing the federal New Markets Tax Credits program, determined that a federal investment of approximately $3,500 to $50,000 in building projects created one permanent job (http://prattcenter.net/reports.php). A National Renewable Energy Laboratory report determined that each investment of $67,045 by the Sacramento Municipal Utility District in building energy efficiency measures created one permanent job. The Economic Policy Institute estimates that an investment of between $82,000 and $100,000 in infrastructure renovation creates one permanent job (http://www.epi.org/subjectpages/stimulus.cfm).

By comparison, as the chart below illustrates, neither ‘clean’ coal plants, nor nuclear plants, can compete with the clean energy, cheap price, widespread economic benefits and job creation of building energy efficiency. Investing the same $21.6 billion in either ‘clean’ coal plants or nuclear plants costs significantly more (rather than saving consumers money), replaces far fewer conventional coal plants, reduces CO_2 by far less and would create no new jobs, since the jobs created by these new plants would simply replace existing conventional coal plant jobs.

$21.6 BILLION
Investment in Energy Production

	Building Efficiency	Coal (CCS)	Nuclear
Conventional Coal Plants (500 MW)	**-22.3 Coal Plants** **-204 BCF Natural Gas** **-10.7 MB Oil**	-6.6 Coal Plants	-7.2 Coal Plants
CO_2 Emissions	**-86.7 MMT CO_2**	-21.1 MMT CO_2	-23.0 MMT CO_2
Annual Consumer Savings	**$8.46 Billion**	$0 Billion	$0 Billion
Job Creation	**216,000 Jobs**	0 Jobs	0 Jobs

In addition, because building is a local activity (construction jobs cannot be outsourced), the money invested in this sector is spread across the entire country and across all industries from wood, metals and glass to sealants, paint and banking. Both the $21.6 billion invested and the $8.46 billion saved on energy bills will cycle through the economy several times.

The Cost of Energy Production

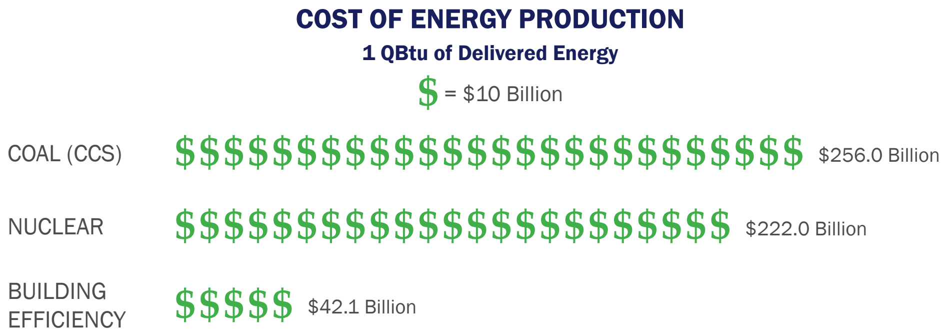
A comparative analysis of the cost of energy production also provides useful information. As shown in the chart below, the cost to build enough new coal plants with CCS to produce just one QBtu of delivered energy[11] would be $256 billion[12]. The cost to build enough nuclear plants to produce just one QBtu of delivered energy is $222 billion[13]. The cost to incorporate energy efficiency measures into residential and commercial buildings to negate the need for one QBtu of delivered energy is $42.1 billion[14].

[11] Delivered Energy is the energy consumed by an end-user on site, not including electricity generation and transmission losses.

[12] FutureGen, the 275 MW coal-with-CCS demonstration plant cancelled by the Department of Energy in January 2008 due to escalating costs, was projected to cost $1.8 billion at the time of cancellation. To be conservative, this study based its calculations on the $1.8 billion figure to estimate the cost of producing one delivered QBtu of electrical energy using coal with CCS technology. It should also be noted, that the cost to build a conventional 1000 MW coal-fired power plant today is approximately $2.6 billion, or it would cost $122 billion to produce one delivered QBtu of energy, about three times the cost of building efficiency measures. (http://www.nytimes.com/2008/01/31/business/31coal.html?_r=1&oref=slogin).

[13] For this study, the conservative number of $6 billion was used for the cost of constructing a 1000 MW nuclear power plant. Recent reporting reveals that the actual figure can be significantly higher, e.g., the Progress Energy Florida 2-1100 MW nuclear plant is expected to cost $17 billion (http://www.platts.com/Nuclear/News/6812261.xml). The nuclear industry is also heavily subsidized by taxpayer dollars.

[14] Cost of a delivered QBtu in the building sector is equal to $21.6 billion (cost of a primary QBtu) x 1.95 (multiplier for energy losses) or $42.1 billion.



While coal with CCS is at least 20 years out and a single nuclear plant takes 8 to 12 years to get on line, energy efficiency measures can be implemented today – at today's prices with off-the-shelf materials, appliances and equipment.

The 2030 Challenge

In January of 2006, Architecture 2030 officially issued the '2030 Challenge', a measured and achievable strategy to dramatically reduce global GHG emissions and fossil-fuel consumption in the Building Sector by the year 2030. Specifically, the Challenge calls for 1) all new buildings and developments to be designed to use half the fossil fuel energy they would typically consume, i.e., half the regional or country average for that building type, 2) at a minimum, an equal amount of existing building area be renovated annually to use half the amount of fossil fuel energy they are currently consuming, and 3) the fossil fuel reduction standard for all new buildings be increased to 60% in 2010, 70% in 2015, 80% in 2020, 90% in 2025 and carbon neutral by 2030 (using no fossil fuel GHG-emitting energy). We recommend the fossil fuel reduction targets be achieved through design, the application of renewable energy technologies and/or the purchase of renewable energy (20% maximum).

Those adopting the 2030 Challenge are encouraged to achieve the reductions called for largely through proper design, i.e., building shape and orientation, natural heating and cooling, daylighting and ventilation strategies, proper shading and straightforward, off-the-shelf building energy efficiency measures.

The Challenge has had a significant national impact, having been adopted by the American Institute of Architects, the U.S. Conference of Mayors (for all buildings in all cities; Resolution #50), U.S. Green Building Council, National Association of Counties, California Public Utilities and Energy Commissions, and individual cities, counties and states. The Challenge targets, part of the Energy Bill passed by Congress and signed by the President in January of this year, are now required for all new and renovated federal buildings beginning in 2010.

Each year in the U.S., we build approximately 5 billion square feet (sq. ft.) of new building, renovate approximately 5 billion sq. ft. and demolish approximately 1.75 billion sq. ft. of existing buildings. By the year 2038, three-quarters of the built-environment in the U.S. will be either new or renovated. This transformation of the built-environment over the next 30 years represents an opportunity to dramatically reduce i) Building Sector energy demand and ii) the need for existing conventional coal-fired power plants.

Conclusions

There is a clear, simple, realistic and achievable solution to climate change that also offers significant additional benefits: building energy efficiency. Of the energy and climate change solutions proposed today, building energy efficiency is the one that can be implemented immediately, costs the least and offers the greatest benefits to both the planet and the economy. With a single action, the U.S. can begin replacing coal, reduce CO_2 emissions, strengthen the US economy, save consumers billions of dollars and create jobs.

The clear winner in the energy solutions comparison being considered today is building energy efficiency. The clear winner in building energy efficiency is the U.S. worker and citizen. Because the call for a moratorium on conventional coal plants allows for the phasing out of existing plants, there will be time to retrain coal workers for new jobs.

By addressing several key factors, the 2030 Challenge offers a comprehensive, effective approach to the Building Sector's role in the climate change crisis. The Challenge calls for the necessary reductions required to avert dangerous climate change, is achievable within the timeline set by scientists, centers on building energy efficiency and renewable energy as the preferred means to achieve the reductions called for, and is already widely adopted.

To bring about the demand-side reductions of CO_2-emissions in the Building Sector necessary to meet a complete phase out of conventional coal-fired power plants by 2030, updating the National Energy Conservation Code Standard to meet the 2030 Challenge targets should be implemented immediately along with a federally-funded building energy efficiency investment package.

Recommendations

To make the 2030 Challenge and building energy efficiency solution a reality, Architecture 2030 recommends the implementation of the following plan of action, titled the '2030 Blueprint':

The 2030 Blueprint

1. Implement an immediate moratorium on the construction of any new conventional coal plants, and the gradual phasing out of all existing conventional coal plants by 2030 to:

- place an immediate cap on coal plant emissions while allowing time to retrain coal workers for new jobs.

2. Require that all developments using federal funds meet the 2030 Challenge targets to:

- create additional models of building energy efficiency for the marketplace.

3. Upgrade the National Energy Conservation Code Standard to the 2030 Challenge targets for residential and commercial buildings to:

- immediately stabilize and begin reducing energy demand in the Building Sector.

4. Invest $21.6 billion each year for five years in building energy efficiency measures through existing federal programs (i.e. New Markets Tax Credits; Low Income Housing Tax Credits; a five-year extension and increased funding for efficiency in the Energy Policy Act) and new energy efficiency incentives, tax credits and programs to:

- stimulate building construction
- reduce annual Building Sector energy consumption by 5 QBtu
- reduce annual U.S. CO_2 emissions by 433.5 MMT
- save consumers $128 billion (which more than covers the cost of this solution), and
- create more than one million permanent new jobs

5. Fund and implement a joint labor-management job training program for displaced coal industry jobs based on successful models developed over the past two decades in the tire/rubber, steel, automobile and communications industries.

Congress is currently 'casting about' for solutions to both the climate crisis and the U.S. economic crisis. The 2030 Blueprint tackles both crises at once. For just a small portion of the $168 billion that Congress recently earmarked to inject into the struggling economy, the U.S. can reduce its greenhouse gas emissions and create jobs and an economic stimulus package that ripples throughout the U.S. economy.

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Building Sector: **A Hidden Culprit** A Historic Opportunity Case Studies

THE BUILDING SECTOR: A HIDDEN CULPRIT

With so much attention given to transportation emissions, many people are surprised to learn that buildings are the single largest contributor to global warming. In order to clarify this misconception, Architecture 2030 has reshaped the debate surrounding climage change and GHG emissions to define and include a Building Sector.

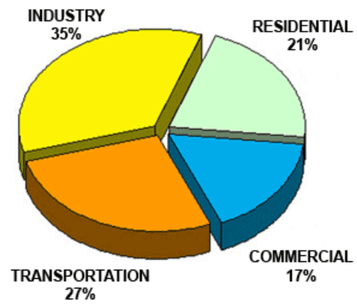
Previous pie charts distributed the various elements of the Building Sector into several sectors, i.e. industry, commercial, residential, transportation and so on. To determine the real energy impact of buildings, Architecture 2030 combined these various elements into a single sector called Buildings.*

Data from the US Energy Information Administration illustrates that buildings are responsible for almost half (48%) of all energy consumption and GHG emissions annually; globally the percentage is even greater. Seventy-six percent (76%) of all power plant-generated electricity is used just to operate buildings. Clearly, immediate action in the Building Sector is essential if we are to avoid hazardous climate change.

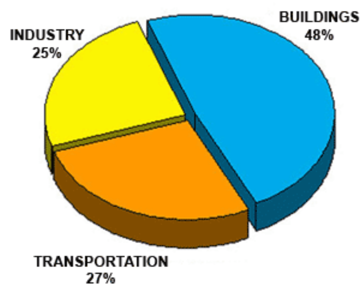
*To create a US Building Sector percentage for the year 2000, the Residential buildings (operations) sector (20.4 QBtu), Commercial buildings (operations) sector (17.2 QBtu), Industrial sector - buildings operations (2.0 QBtu) and the Industrial sector - annual building construction and materials embodied energy estimate (8.57 QBtu) were combined. Total annual 2000 Building Sector consumption was 48.17 QBtu and the total annual 2000 US Energy consumption was 99.38 QBtu. Source: US Energy Information Administration (consumption numbers vary slightly depending on the EIA table used. To be conservative, Architecture 2030 rounded down).

The annual embodied energy of building materials and the energy used to construct buildings is estimated at 1.146 MBtu/sf of building for new construction and half of this for renovation. Source: US Energy Research and Development Administration. At the current rate of construction in the US of approx. 5 Bsf of new building and 5 Bsf of renovation (EIA and Dodge), the total annual energy consumed is approx. 8.6 QBtu, or 8.6% of total US annual energy consumption.

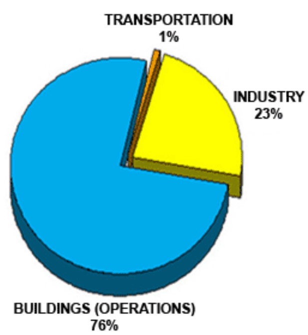
Residential, commercial and industrial building operations consume 76% of total US electricity generation.



US Energy Consumption (Figure A)



US Energy Consumption (Figure B)



US Electricity Consumption (Figure C)

- Building Sector:
- **A Hidden Culprit**
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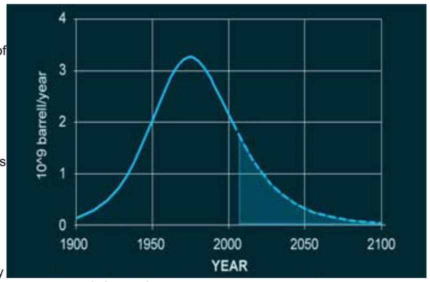
CONVERGING EVENTS

There are two global events converging to create the most significant crisis of modern times. The first of these is the escalating consumption of energy and resulting depletion of fossil-fuel resources. The second major event threatening our planet is global warming.

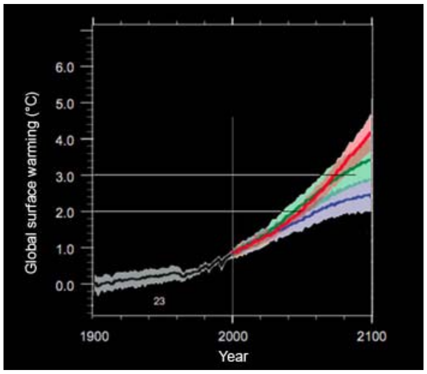


US Crude Oil Production Projection (Figure A)
Source: Energy Information Administration, Department of Energy

Energy
The US peaked in oil production in the 1970's (**Figure A**). We have since exhausted 75% of all the known oil reserves in the US, and we are now on our way to consuming the remaining 25%.

The US peaked in natural gas production in 1973, and in order to keep gas production steady in the US, we have had to drill thousands more wells every year. We have very little remaining oil and gas reserves.

Global Warming
Currently, global warming is at 0.7°C above pre-industrial levels (**Figure B**). Scientists tell us that in order to avoid dangerous climate change we must keep global warming under 2°C above pre-industrial levels. If we reach 3°C, we could potentially cause catastrophic climate change.



Earth's Surface Temperature (Figure B)

- **The Science:**
- **Converging Events**
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- **CO2 Levels**
- **CO2 and Temperature**

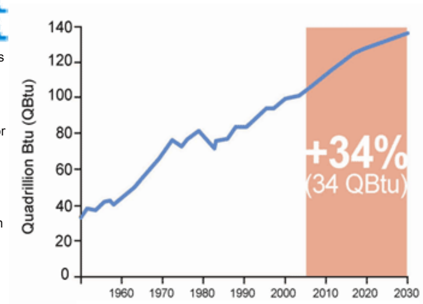
ENERGY CONSUMPTION PROJECTIONS

1 QBtu = annual energy output of 40 1,000 MW power plants

Energy consumption is measured in "Quads" (Quadrillion Btus). One Quad equals the delivered energy of 40 1000-Megawatt power plants, i.e. 40 large nuclear power plants, or approximately 75 500-Megawatt conventional coal plants.

The US currently uses approximately 100 Quads of energy annually. The US Energy Information Administration (EIA) projects that over the next 25 years, US energy consumption will increase by 34 Quads, or 34% (**Figure A**).

The world, including the US, uses approximately 400 Quads of energy annually. EIA projects that over the next 25 years, world energy consumption will increase by 276 Quads, or 62% (**Figure B**).

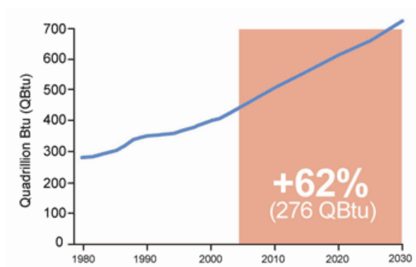


US Energy Consumption Projections (Figure A)
Source: US Energy Information Agency Statistics Center

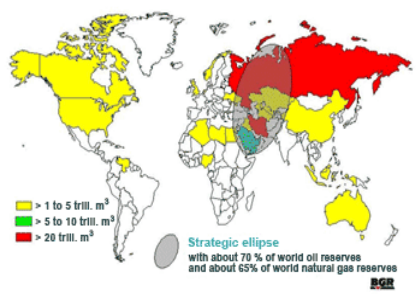
Where will all of this energy come from?
Seventy percent of the remaining global oil and gas reserves are located in what is called the strategic ellipse - an area stretching from Saudi Arabia up through Russia (see **Figure C**). These reserves have now become a political as well as an economic commodity, making the availability of these reserves uncertain.

So, what other energy options are available?
The US has large reserves of coal. The former Soviet Union & Russia have large reserves. Asia Pacific, China and Australia also have large reserves and are presently distributing their coal throughout Southeast Asia.

The environmental, safety, cost and security concerns associated with nuclear power plants, and the fact that conventional coal is one of the largest emitters of greenhouse gases, precludes these two methods of energy production as viable solutions in the face of global warming.



World Energy Consumption Projections (Figure B)
Source: US Energy Information Agency Statistics Center



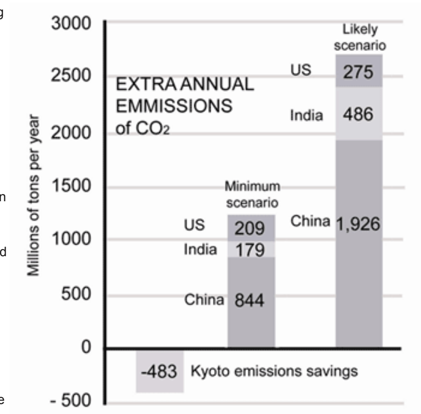
Countries with natural gas reserves > 1 trill. m^3 (Figure C)

CO2 LEVELS

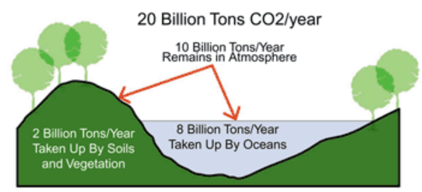
Meeting our current and future energy needs by continuing to burn fossil fuels will lead to further global warming. Assuming all the countries that signed the Kyoto Protocol met their commitments by 2012, the vast number of additional coal plants now being planned for the US, India and China, and their consequent emissions, completely negate the gains that might have been made by the treaty (**Figure A**).

Additionally, substantial amounts of CO2 released into the atmosphere have long-term consequences. The planet can only absorb a finite amount of CO2 (**Figure B**). Of the 20 billion tons of CO2 currently being released into the atmosphere, approximately 10 billion tons can be absorbed by the planet. The additional 10 billion tons released into the atmosphere remains there, and fuels global warming. Continuing to increase the amount of CO2 in the atmosphere is a huge experiment by the human race on our planet.

Paleoclimate information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1300 years. The last time the polar regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 metres of sea level rise.



Surge of new coal-fired plants built in China, India and the United States (Figure A)
Sources: UDI-Platt"s, US Energy Information Administration and Industry Estimates; Scott Wallace - staff



Atmospheric CO2 Content Rises 1.7 Parts per Million/Year (Figure B)
Source: Fossil Fuel CO2 and the Angry Climate Beast, W.S. Broecker

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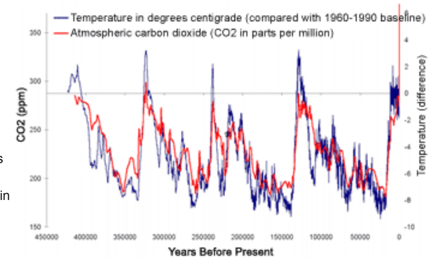
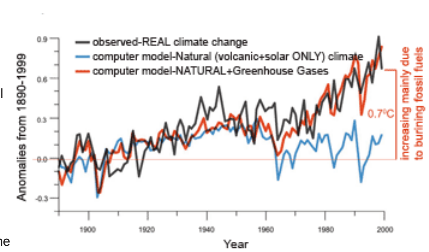
CO2 AND TEMPERATURE

Until modern industrial times, the earth's surface temperature approximately followed atmospheric CO2 levels. Today, this is no longer the case. Surface temperatures are lagging behind CO2 increases (**Figure A**).



Temperature and CO2 Levels (Figure A)

This sudden and dramatic increase in atmospheric CO2 levels cannot be attributed to natural phenomena, such as solar and volcanic activity, and is therefore a cause for serious concern. There is currently a 0.7°C (approx.) rise in temperatures above pre-industrial levels, and if surface temperatures continue to follow CO2 emissions, temperatures will likely continue to rise (**Figure B**).



Temperature Anomalies, 1890-1999 (Figure B)
Source: www.whrc.org/

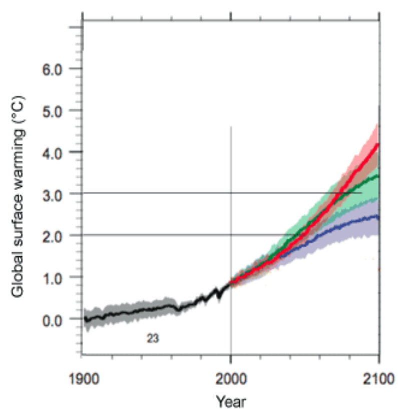
Assuming a business-as-usual scenario, scientists' predictions indicate a roughly 50% probability that global surface temperatures will rise relative to increasing CO2 levels and we will reach warming of 2°C above pre-industrial levels by 2050, and 3 degrees by 2100 (**Figure C**). If we do not make the necessary CO2 and other greenhouse gas reductions quickly, this warmer planet will be the world our children and grandchildren will inherit.

Dr. James Hansen has stated:
"Warming of more than 1 degree Celsius above today's level will make the Earth warmer than it has been in a million years.

The Earth's history suggests that with warming of 2-3°C the new equilibrium sea level will include not only most of the ice from Greenland and West Antarctica, but a portion of East Antarctica, raising sea level of the order of 25 meters (80 feet)... real world data suggest substantial ice sheet and sea level change in centuries, not millennia.

Action must be prompt, otherwise CO2-producing infrastructure that may be built within a decade will make it impractical to keep further global warming under 1°C."

Dr. Hansen has set a timeline of ten years. We have ten years to make the changes necessary to keep warming from reaching 2°C above pre-industrial levels.



Earth's Surface Temperature (Figure C)

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