BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

SUBCOMMITTEE ON CLEAN AIR, CLIMATE CHANGE, AND NUCLEAR SAFETY

HEARINGS ON POWERPLANT MULTIPOLLUTANT LEGISLATION

TESTIMONY OF JOEL BLUESTEIN

MAY 8, 2003

Summary of Testimony

Natural gas prices are likely to be higher in the future than in the last 15 years and power generation is the fastest growing component of natural gas demand. New multipollutant regulations are not a primary driver for the increase in gas prices, however. In addition, higher gas prices are likely to reduce the potential for wide-spread switching from gas to goal as a result of increased regulation. Finally, a gradually implemented multipollutant program that rewards the development and implementation of new technology could promote a more balanced mix of power generation assets and help avoid over-reliance on gas.

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Introduction

Thank you Mr. Chairman and members of the Subcommittee for the opportunity to testify today. My name is Joel Bluestein and I am the President of Energy and Environmental Analysis, Inc. EEA is located in Arlington, Virginia and has been providing energy and environmental consulting services since 1974. Among our major areas of expertise are:

- Analyzing and forecasting the supply, demand and price of natural gas
- Analyzing the impacts of regulatory policy on energy markets
- Analyzing new energy technologies in the context of environmental regulations.

We have done this work for natural gas producers, pipelines, local distribution companies, power generators, technology developers, the U.S. Department of Energy, the U.S. Environmental Protection Agency and other public, private and institutional clients. I have been at EEA for 14 years and have over 20 years of experience in the energy and environmental field.

Today I'd like to briefly share with you our current outlook on supply and price of natural gas in North America and some views on the relationship between that outlook and multipollutant legislation.

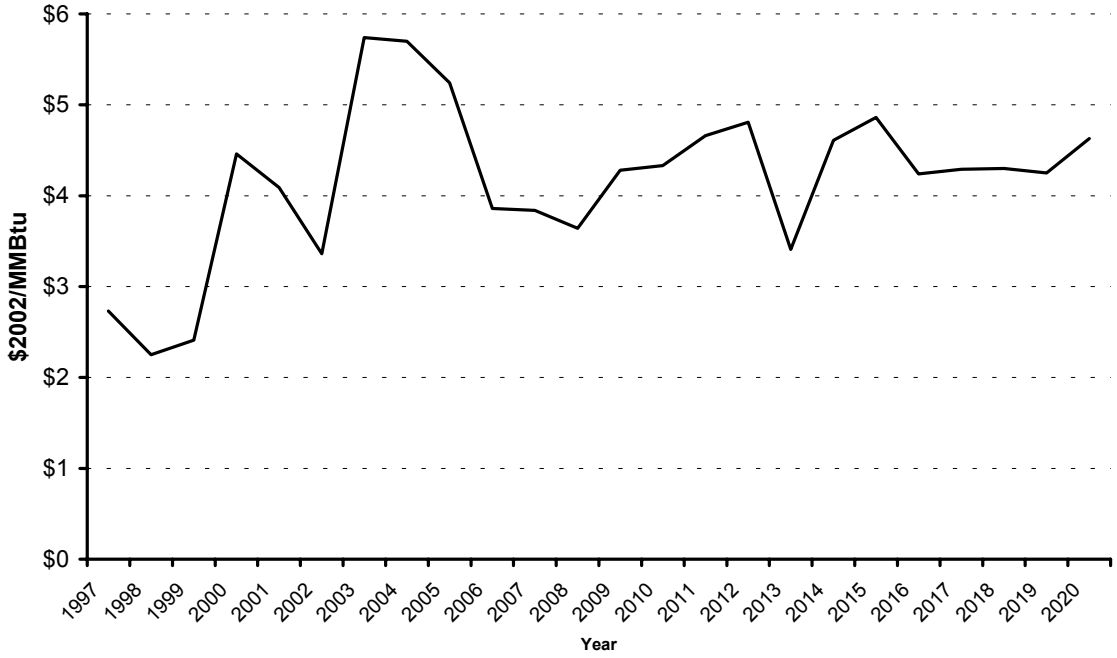
Gas Price Forecast

EEA quarterly prepares a 20 year forecast of North American natural gas supply, demand and price that we call our Natural Gas Compass. Figure 1 summarizes our current view of the price for natural gas over that period. It shows that we expect gas prices at the Henry Hub to average about $5.70/MMBtu (in constant 2002 dollars) for the next two years and decline to a level around $4.50/MMBtu for the remainder of the period except for brief periods later in the forecast.

This is a significant increase from gas prices over the last 15 years, which have mostly stayed below $2.50/MMBtu. The roots of this change have been quite visible in the last few years and reflect the end of the "gas bubble" of the 1990s or more precisely the fact that the balance of supply and demand for natural gas has been growing tighter in recent years. A tighter balance between supply and demand results in higher prices and increased volatility. This does not mean that we are "running out" of natural gas, it does mean that gas producers need to look further afield and spend more money to meet the demand for gas, and that is reflected in the price.

Figure 1

EEA Forecast of Natural Gas Price at Henry Hub



Our forecast includes new development of natural gas in several U.S. areas including Alaska, the deep Gulf of Mexico and the Rockies as well as imports from the Mackenzie Delta in Western Canada and the Maritimes area off of Canada's east coast. We also project increased imports of liquefied natural gas (LNG) through the four existing LNG terminals and the addition of several new LNG terminals in the later part of the forecast. Finally, we project that adequate pipeline capacity must be constructed to bring the gas to places where it is needed.

This scenario reflects what we see as a realistic though challenging period of growth for the natural gas industry. It requires very large investments of capital, though not more than has been invested in the past. It also requires a variety of positive policy decisions such as support for an Alaskan gas pipeline, development of LNG terminals, construction of other new pipelines, etc. If any of these does not occur, the price forecast is higher. One might say that there is more upside potential than downside on gas prices.

This price forecast is driven by the consumption of natural gas growing from 22.3 trillion cubic feet (Tcf) in 2002 to 28.2 Tcf in 2015 and 30.4 Tcf in 2020. The largest portion of this growth is in the power generation sector, growing from 4.3 Tcf in 2002 to 8.4 Tcf in 2015 and 9.5 Tcf in 2020. While there is some variation, these consumption projections are not significantly different from those developed by other forecasters, including the U.S. Energy Information Administration.

So I agree with the basics of much of what has been said on this topic:

- The gas supply/demand balance has gotten tighter and will remain tight.
- Gas prices will be higher than in recent history, perhaps significantly higher.
- Power generation will be the major growth sector for gas demand.

Relationship to Multipollutant Regulation

The question of how we can best and most appropriately ensure an adequate gas supply is a complex and important one that is already being addressed in other forums. I think the question for today is: "What does this gas price outlook say about environmental regulation of the power generation sector?"

The EEA forecast does not include any significant switching from coal to gas in the power generation sector. We do include the large amount of new gas-fired generation that has been built in recent years, about 150 GW from 1998 through 2002, and continued construction of new gas capacity in the near future. We also project new coal capacity coming on line, mostly after 2010.

It must be pointed out that, in certain areas, this new gas capacity actually reduces gas consumption by replacing older, less efficient gas generation. We have seen old gas plants retired in Texas because they cannot compete with the new, more efficient gas plants. It's been estimated that replacing all of the old gas plants in Texas with new, state-of-the-art gas combined cycle plants could reduce gas consumption for power generation by over 200 Bcf per year. The use of even more efficient combined heat and power (CHP) can make this reduction even greater. The same is true in other parts of the Southwest, as well as parts of the West, South and Northeast. In some states where markets have not opened up yet, this potential is currently being lost because incumbent utilities can choose to dispatch their old less efficient plants rather than the new plants.

There seems to be a lot of concern that, either on its own or due to various environmental restrictions, the demand for gas for power generation will inexorably grow until it threatens our economy. I think this concern is overstated and unfounded, certainly as regards the power generation sector. Although we see continued growth in new gas-fired generation, we do not expect massive switching from coal to gas under any 3-P regulatory scenario currently being discussed.

At the gas prices we are forecasting, switching to gas will not be the most economic choice except for the least economic, highest cost-of-control coal plants. The capital cost of a new combined cycle plant is much less than a new coal plant, but still much more than the cost of even a complicated control retrofit at most coal plants. And then, the cost of fuel for even an efficient new combined cycle gas plant at $4.50/MMBtu is over $30/MWh. This is almost three times the fuel cost for even an inefficient coal plant burning coal at $1/MMBtu or less. There is a lot of money to be made on the coal side of that competition. This is reflected in the U.S.

EPA's extensive modeling of regulatory scenarios in which they are hard-pressed to show any significant switching to gas even with gas prices two or three times lower than the prices we are forecasting.

The higher gas prices go, the better the economics of coal look. We might have greater concern over switching if there were no way to burn coal efficiently and cleanly. But this is not the case. There are many coal plants today that efficiently and economically limit their SO_2 and NO_x emissions and are highly competitive in the market. New coal plants being built are even cleaner. New coal technologies being developed, such as integrated gasification combined cycle plants, are cleaner and more efficient yet.

New technology is vital to addressing control additional pollutants such as mercury or even CO_2. The concern then becomes whether the appropriate technologies will be available to provide adequate reductions. In the history of pollution control programs, industry has always found ways to control pollution more effectively and less expensively than originally thought possible. But that may be little comfort to plant owners who face a new set of pollution control challenges.

Multipollutant programs like the Clear Skies Act and those proposed by Senator Jeffords and Senators Carper, Chafee and Gregg, despite differences in detail which I don't propose to address, all will likely help the development of new, clean coal generation by providing increased regulatory certainty and flexibility to find effective compliance solutions. Emission cap and trade programs provide a variety of tools to address the problem, including: the timing and stringency of the cap, cost mitigation measures and availability of off-sector trading.

One shortcoming of the Clear Skies Act in supporting new technology is that the "grandfathering" approach to allowance allocation disadvantages new plants in general and new coal plants in particular. The failure to allocate allowances to new coal plants creates a disincentive for companies to develop these plants and drives the power sector more towards gas. An allocation approach that includes new plants and rewards efficiency is one way to help ensure that we can continue to rely on our substantial coal resources.

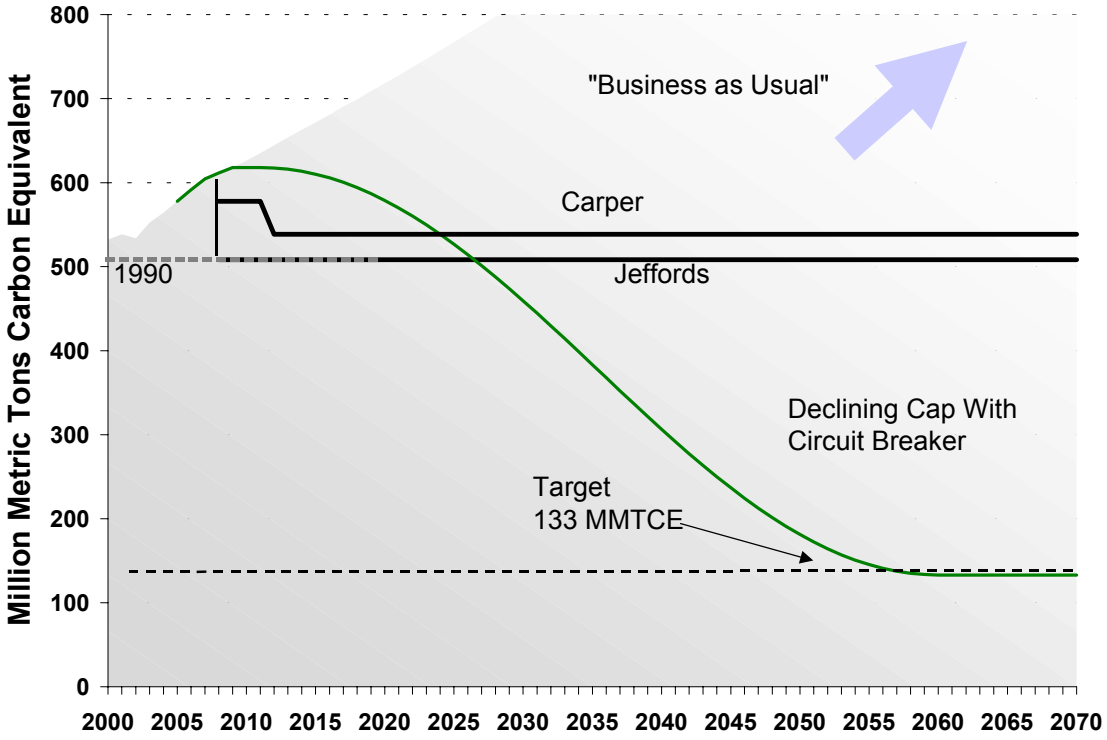
I agree with those who endorse phased implementation of emission caps. However, I would add that starting the programs earlier and phasing them in more gradually is critical to ensuring the availability of appropriate technology. Development of new technology requires a driver, which in this case is regulation. Then technology development needs money and time for research, development and commercialization. Command and control programs and cap and trade programs with large reduction steps don't provide enough time for technology development. However, delaying the imposition of the regulation doesn't provide a sufficient driver for development. A series of gradual steps can jump-start technology development and keep it moving.

This can be illustrated for the topic that probably creates the greatest concern for over-reliance on natural gas - CO_2 reduction. I think it's clear that switching to gas alone is not an adequate

approach to CO_2 mitigation. CO_2 reduction will require a mix of gas, renewable, and advanced coal technologies such as integrated gasification combined cycle with sequestration or coal-based hydrogen production, combined heat and power and other efficiency measures. Overly aggressive near-term reduction requirements will not help us promote the development of new technologies. On the other hand, neither will continued delay of regulation. The point was made at the last hearing on this topic that delay in addressing CO_2 regulation is one more reason that companies are reluctant to construct new coal capacity today. Finally, the long-term reduction goals required to address climate change are much greater than the levels currently being discussed even in 4-P legislation and must be recognized early to provide the right direction.

Figure 2 shows a cap and trade approach that applies gradual CO_2 reductions to jump-start technology development and promote long-term solutions while avoiding near-term economic disruption, including excessive switching to gas. In fact, in this approach, the emission cap increases for the first several years, then levels off and begins a very gradual decline. It is designed to reach an 80 percent CO_2 reduction by 2060, which is calibrated to meeting a 450 part per million (ppm) atmospheric CO_2 level. An economic "circuit breaker" could be used during the declining portion of the program to adjust the rate of decline and avoid economic disruptions.

Figure 2
Example of a Gradually Declining Cap on Carbon Emissions from the Power Generation Sector



This approach would send an immediate signal that new technology is required and provide financial support for new technology through an immediate, active market in CO_2 allowances, even though reductions are not immediately required. It would provide immediate financial return for "no regrets", voluntary actions while reducing the transaction cost and verification concerns. The schedule would also avoid any immediate devaluation of existing assets, since major reductions don't start until 2015. At the same time it makes a commitment to meet the long-term goals. More information on this approach is included as Attachment A. A similar, less gradual approach could be used to promote new technology for mercury control.

Conclusion

In conclusion, we do see higher gas prices in the future, regardless of what regulations are imposed on the power generation sector. This increase and its implications need to be addressed separately from their implications on multipollutant regulation. However, higher gas prices will increase the value of new, clean, efficient coal technologies. We need to continue the use of coal as a major component of our power generating mix. However, the future of coal-based generation should not be the continued use of 50 year old plants but rather the construction of new, more advanced coal technologies. That, in fact, is probably the long-term path to wider use of coal in our economy through the development of coal-based liquid fuels or hydrogen. Multipollutant legislation can encourage the development of those technologies by providing equitable allowance allocations for new plants and by setting gradually declining emission caps from an early starting point.

Thank you again for this opportunity to speak and I'll be happy to respond to any questions at the appropriate time.

Testimony of Joel Bluestein
Attachment 1

CO_2 Reduction with a Declining Cap/Circuit Breaker

CO_2 Reduction with a Declining Cap/Circuit Breaker

Joel Bluestein
Energy & Environmental Analysis, Inc.
May 8, 2003

What Are We Worried About?

- The cost will be huge.
- The primary compliance path will be coal-to-gas switching.
- Coal producers and users will be harmed.
- High gas and electricity prices will harm all consumers.
- The economy will crater.
- Etc.

2

An Alternative Outlook

- Compliance will be achieved through a mix of fuels and technologies, including renewables, sequestration and advanced coal technology.
- Phased implementation will avoid stranded investments.
- The U.S. will maintain a balanced energy mix, including coal.
- Costs to industry and consumers will be minimized.

3

Principles for CO_2 Regulation

- Climate change is a long-term problem. We need to look for long-term solutions.

Renewables	Clean coal
Efficiency	Sequestration

- We need the right structure to promote these technology solutions.
- Getting started with the right structure is more important than knowing exactly where we are going.

4

The Technology Solution

- Cost-effective carbon mitigation will rely on technologies that we can't clearly foresee today.
- New technology requires:
  - A clear driver - the push has to be there.
  - Money - the capital and the market must be there.
  - Time - even then, new technology takes time.
- We need to start early with clear but gradual regulatory and economic drivers.

5

Things We Don't Know

- Will the technology work?
- How much will it cost?
- Will the market work?
- How much will the allowances cost?
- How much reduction do we need?

We can't predict for sure.

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Some Things We Know

- Our predictions aren't very good.
- Compliance costs turn out lower than we think expect.
- The cap levels aren't low enough.
- In the end, the markets work.

But how much are we willing to bet?

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Cap and Trade Design Toolbox

- Cap timing
- Cap level
- Cap coverage
- Allocation

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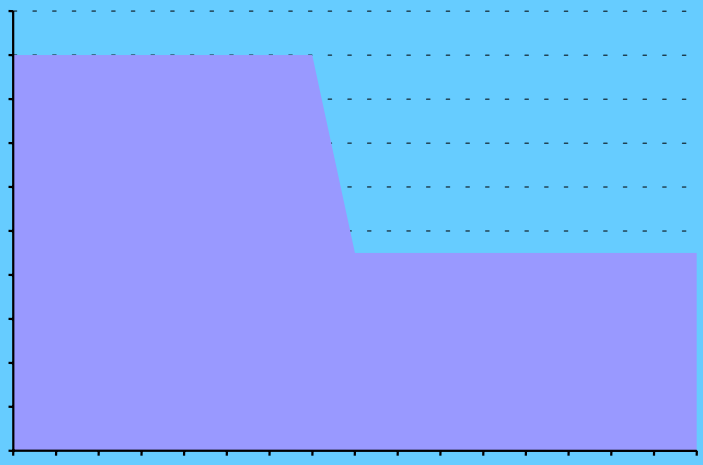
Traditional Emission Cap Profile



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Declining Cap

The ramp, not the cliff.

- The cap decreases by a fixed percent each year. Glide slope defined in advance.
- Test the markets and technologies gradually, with low risk.
- Provide immediate price discovery and monetization.
- Provide a clear driver for new technology and long-term results.

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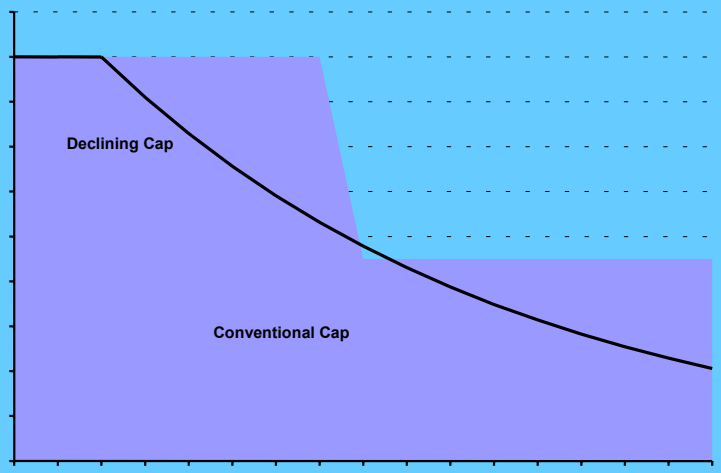
Classic Declining Cap



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A Workable CO_2 Cap Approach

- Near-term cap *levels* are not important.
- Implementing an immediate, gradual cap creates the driver and the economic value.
- Limit near-term risk.
- Encourage long-term technology solutions.
- Meet long-term goals.

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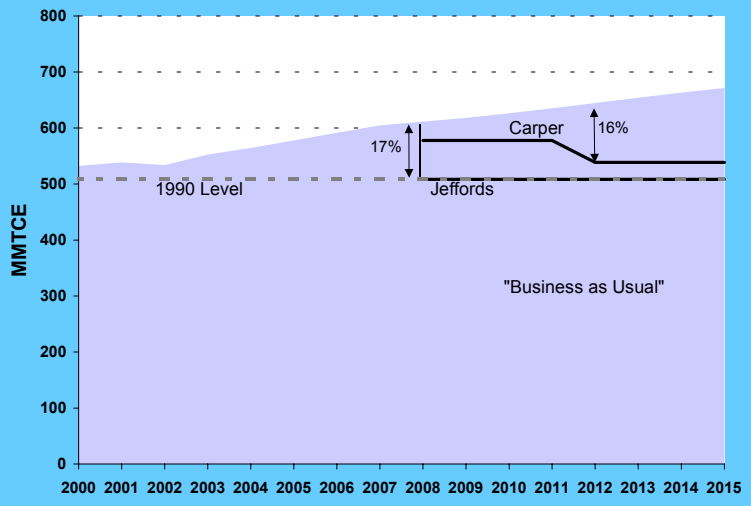
If This Looks Difficult...



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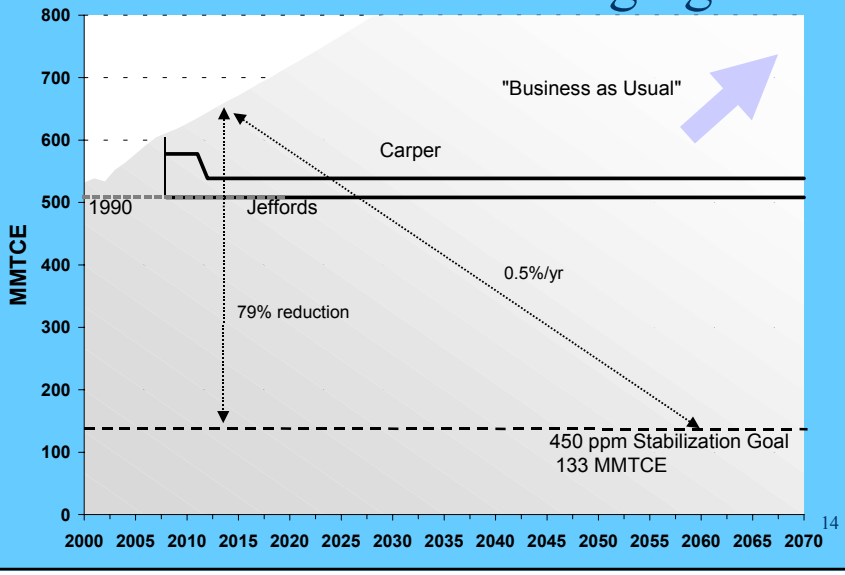
The Ultimate Goal is Even More Challenging!



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Current Approaches

- Too scary.
- Don't promote the right technology answers.
- Don't reach the goal.
- Don't provide certainty.

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3-Step CO_2 Reduction Plan

- Phase I - 2005-2008 cap *with no reductions*
- Phase II - 2009-2012 zero growth transition period
- Phase III - very gradual reductions with economic circuit-breaker

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Phase I - "immediate" cap *with no reductions*

- Cap based on "business as usual" projection.
- Does not force reductions but:
  - Creates a clear economic value for early reductions and new technology.
  - Enables verifiable "voluntary" reductions.
  - Reveals cost/value of reductions.
  - Maintains value of existing assets.
  - Avoids disruptions and uncertainty.

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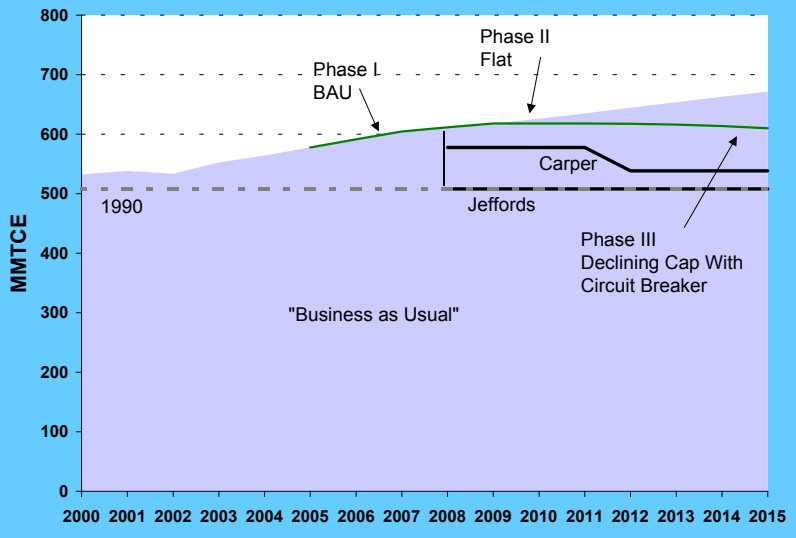
Phases I and II



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3-Step CO_2 Plan (Cont.)

- Phase II - zero growth transition period.
- Phase III - very gradual reductions with economic circuit-breaker.
  - Sets commitment to long-term goal.
  - Provides economic driver/value for new technology.
  - Limits economic impact.

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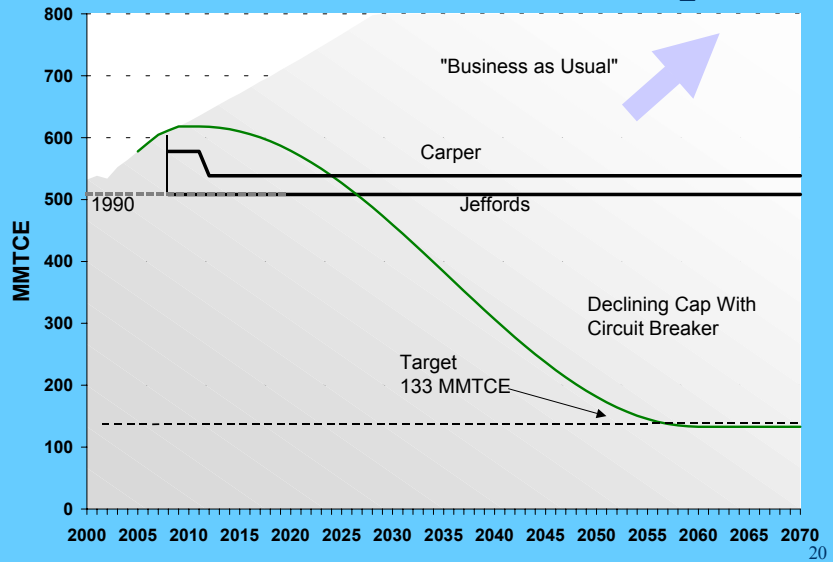
Declining Cap for CO_2



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Circuit Breaker

- Decline stops if annual average allowance cost exceeds predetermined cost threshold ($/ton).
- Decline starts again when the annual average cost is below threshold.
- Cap is never exceeded.
- Cost can exceed circuit breaker price.

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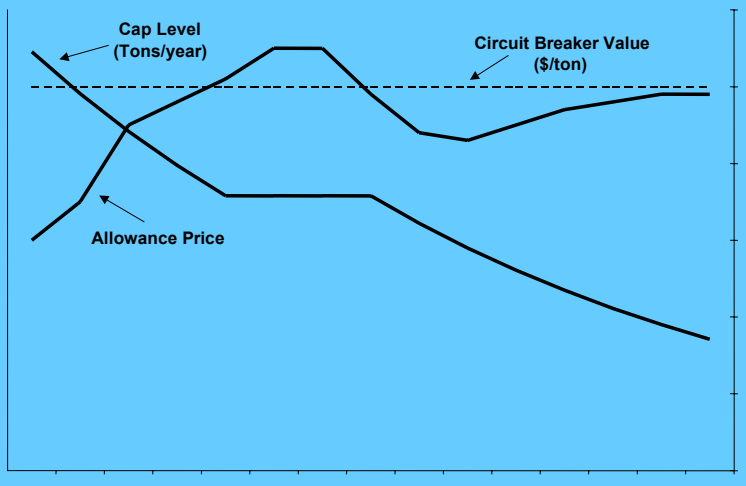
Circuit Breaker Operation



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Setting the Circuit Breaker

- The "correct" answer is a function of technical issues that we can't forecast.
- The acceptable answer will be:
  - What level does not disrupt the electric industry/fuel choice balance (gas/coal spread)?
  - What cost is reasonable for consumers?
- If history is a good guide, setting it too low won't be a problem.

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Refinements

- Accelerator - converse of circuit breaker, accelerates decline if allowance price is low.
  - Probably related to new technology.
- Backstops - Reset circuit breaker if progress is stalled.

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Possible Program Parameters

- Base on electricity cost impact - say \$0.005/kWh=\$5/ton CO_2.
- Backstop - reset circuit breaker if it is tripped for 5 years straight.
- Accelerator trips if price less than 50 percent of circuit breaker for three years.

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Allocation Approach

- Allocation does not affect cap but can promote beneficial technologies.
- Need to allocate allowances to new sources - updating
  - Then output-based allocation.
- Alternatives that provide same driver are possible.

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Impact of Allocation

- Emission cap literally applies to combustion-based generation.
- Allocation of allowances can help encourage alternative solutions:
  - Renewable generation
  - End-use efficiency
  - Sequestration

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Potential for Gaming

Will generators increase control cost to trigger circuit breaker?

- First incentive is to reduce generating cost, increase sales, not increase cost of allowances.
- Not clear that it is economically beneficial to purposely trigger circuit breaker - emissions still capped.
- Obvious gaming can be controlled.

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Off-Sector Reductions

- Gradual implementation and safety value reduce need for off-sector reductions.
- Off-sector sequestration should be included.
- Off-sector reductions could be considered in the future if cost is high.
  - Must be surplus, verifiable, measurable.

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Application to Other Sectors

- Has same limitations as other downstream cap and trade programs.
- Could be applied for large industrial/ commercial boilers.
- Possibly applicable to other homogeneous industries.

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Benefits of Approach

- Meets long-term emission goals.
- Avoids near-term economic disruption, stranded investments.
- Promotes new technologies of all kinds.
- Better driver for balanced energy mix.
- Provides greater environmental and economic certainty

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