Updated
Analysis of National Greenhouse Gas (GHG) Control Legislation on Alaska Energy Prices and Consumer Costs

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Introduction

This memorandum is an update of a similar analysis that explores the possible economic effects on Alaska of proposed GHG control legislation. In this update we focus on a proposed bill that is similar to the "Bingaman-Specter Discussion Draft" that we discussed in March. The current proposal contains a $12/metric ton safety valve price ($12 refers to nominal dollars in year 2012) rather than a $7/metric ton price. Specifically, this analysis is based on a NEMS[1] analysis provided to us by NCEP[2] that is labeled $12 Safety Valve Case." We shall refer to this proposal as "Bingaman-12."

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[1] National Energy Modeling System
[2] National Commission on Energy Policy, "$12 Safety Valve Case" NEMS results, provided by NCEP staff to ISER on 2 July 2007. It is important to note that NCEP has conducted two NEMS modeling scenarios: 1) a $12/ton "Safety Valve" case and 2) a $12 "Policy" case. The "policy" case incorporates other supplemental policies including CAFÉ, while the safety valve case basically just models the $12/ton safety valve price. Officials at NCEP consider the "safety valve" modeling run more of a worst case scenario on energy price impacts. The $12/ton "policy" case shows GHG emissions reduced to 1990 levels by 2030 whereas the "safety valve" case does not show as significant reductions in GHG emissions over the same time period."

Effects on Alaska Energy Producers

Table 1 shows the projected cost of allowances after adjusting for the differing carbon content of fuels. The year 2012 safety valve price of $12 in nominal dollars equates to $10.10 in 2004 dollars. It is *assumed* (as part of the NEMS analysis) that the safety valve price kicks in at least by 2012.

Table 1 Projected Allowance Cost in 2004 $

		2012	2020	2025	2030
CO_2-equivalent price, $ per metric ton		10.10	14.92	19.04	24.31
Allowance prices per fuel unit (real 2004$)					
National averages					
Motor Gasoline (per gallon)	$/gal	0.09	0.13	0.17	0.22
Jet Fuel (per gallon)	$/gal	0.10	0.14	0.18	0.23
Distillate (per gallon)	$/gal	0.10	0.15	0.19	0.25
Natural Gas (per thousand cubic feet)	$/mcf	0.55	0.82	1.04	1.33
Coal, Electric Power (per million Btu)	$/mmbtu	0.95	1.41	1.79	2.29
Alaska-specific:					
coal subbituminous 7,800 btu/lb	$/pound	15.20	22.46	28.66	36.59

Source: ISER calculations using NEMS results from NCEP "$12 Safety Valve Case" and emissions coefficients from http://www.eia.doe.gov/oiaf/1605/coefficients.html (EIA, 2007)
Note: National average coal for electric power allowance price assumes 207.7 lbs CO_2 per million Btu.

Table 2 shows these allowance costs as a percentage of the reference case projected market prices. Thus the emission allowance represents roughly 10-15% of the market price of natural gas, but roughly 100-150% of the price of coal.

Table 2 Projected Allowance Cost:
Ratio of Allowance Cost to Reference Case Market Price

National averages	2012	2020	2025	2030
Motor Gasoline	4%	6%	8%	10%
Jet Fuel	7%	10%	12%	15%
Distillate	6%	8%	10%	12%
Natural Gas	8%	11%	14%	16%
Coal, Electric Power	66%	101%	125%	152%

Source: ISER calculations using NEMS results from NCEP "$12 Safety Valve Case" and emissions coefficients from http://www.eia.doe.gov/oiaf/1605/coefficients.html (EIA, 2007)
Note: National average coal for electric power allowance price assumes 207.7 lbs CO_2 per million Btu.

The allowance cost will be shared by consumers and producers based on consumer demand sensitivity and substitution among competing fuels. As with any increase in the cost of production, producers would try to pass the cost of the CO_2 allowances on to their customers. Energy consumers who are not very responsive to energy price increases will absorb them, while others may be able to partially avoid the increases by reducing their consumption of higher cost energy products or by turning to substitutes, including other fuels, low-energy capital equipment, or non-energy goods and services. To the extent that consumer demand is very responsive to price increases, producers will not be able to pass the entire cost of allowances onto their customers, but will instead be forced to absorb a portion themselves.

Because the Btu cost of coal will increase more than natural gas, consumers will tend to substitute natural gas for coal in national markets, and this will also influence how market prices respond to the costs imposed by the allowances. This shift in demand towards natural gas and away from coal will tend to drive up the market price of natural gas and soften the market price for coal. These and other complex "cross-price" effects make it impossible to predict with certainty the ultimate change in market prices (as opposed to costs to producers) from the imposition of the allowances.

The NEMS projections of future market prices with and without the allowance prices should be viewed with great care and considered as **one, plausible scenario**. With this caveat, Table 3, based on the NEMS "$12 Safety Valve Case," shows the percent increase in projected national fossil fuel market prices above the reference case of no emission controls. Comparing Table 2 and 3 shows that the price of natural gas increases slightly more than the allowance cost through year 2020 while the price of coal increases by slightly less. Table 4 shows the increase in market price relative to allowance costs.

Table 3 Projected Market Price Increase Due to Emission Allowances (Percent)

National averages	2012	2020	2025	2030
Motor Gasoline	4%	6%	7%	9%
Jet Fuel	7%	11%	13%	15%
Distillate	5%	9%	11%	14%
Natural Gas	8%	12%	12%	14%
Coal, Electric Power	66%	99%	118%	139%

Source: ISER calculations using NEMS results from NCEP "$12 Safety Valve Case"

Table 4 Increase in Market Price Relative to Allowance Cost

National averages	2012	2020	2025	2030
Motor Gasoline	95%	94%	94%	93%
Jet Fuel	102%	110%	102%	100%
Distillate	97%	113%	112%	121%
Natural Gas	101%	107%	88%	85%
Coal, Electric Power	100%	99%	95%	92%

Source: Calculated as ratio of Table 3 increases to Table 2 increases.

Discussion

1. Under this NEMS projection, **wellhead natural gas prices** -- measured after netting out allowance costs -- are likely to be higher than reference prices at least through 2020[3], but lower after 2025. The early period net increase is the expected outcome from a strong "substitution effect" from coal to gas, especially in the electric power industry. The later period net decrease is consistent with a substitution away from "all fossil fuels" that exceeds the fuel-switching effect from coal to gas. In particular, the NEMS model in the runs used here is opting for significant amounts of nuclear and IGCC[4]-with-carbon-capture as a source of baseload electricity. This particular scenario reflects a choice by the model based purely on slight economic advantages that these technologies seem to offer based on the cost parameters fed into the model. If more constraints on nuclear power were placed within the model, or if slightly different costs of IGCC-with-capture were used as inputs, the projections would likely favor increased use of natural gas and higher prices.

Because of these conflicting effects playing out over time, it is not possible to calculate a projected numerical change in wellhead value of North Slope gas without making several additional assumptions and/or learning more about what is driving the projected changes in natural gas market prices. However, economic theory strongly supports the idea that if the price of carbon is increased, and if alternatives such as nuclear cannot be rapidly and cheaply deployed, then Alaska natural gas will become more attractive as a proven, low-carbon energy source.

2. The emission allowance cost for **crude oil** ranges from $4.36 per barrel in 2012 to $10.50 per barrel in 2030. However, EIA projections for refined product prices (shown above) indicate that on balance more than 100% of allowance costs are passed through to consumers. Because of this pass through to consumers, the wellhead value of North Slope crude would remain unchanged or might even increase, based on the product mix.

3. **Alaska coal** is not currently traded in U.S. national markets. About 600,000 short tons per year of coal from Healy are exported into world markets (under long-term contracts) and another 850,000 short tons per year are sold to several customers in Alaska who use it for power generation. The exports would likely be exempt from allowance costs levied under this bill. The domestic coal sales are to a regulated electric utility and to public institutions (the military and the University), so it is probable that any allowance costs associated with domestic sales would be passed on to these customers.

[3] We cannot determine the exact year in which the projected market price begins to increase by less than the cost of the CO2 allowance, because we only have numbers for 2020 and 2025. In 2020 market price increase exceeds allowance cost, while in 2025 it does not.

[4] Integrated Gasified Combined Cycle

Effects on Alaska Energy Consumers

Electricity price increases depend on the mix of generation fuels. Table 5 shows estimates of electricity price increases assuming that the full costs of the emission allowances for natural gas, coal, and residual oil are passed on to consumers in the form of higher rates.

Table 5 Alaska Electricity Price Increases from Full Pass-through of Allowance Costs (cents per kilowatt-hour)

		2012	2020	2025	2030
Railbelt electricity					
Blended cost of allowances	cents/kWh	0.6	0.9	1.1	1.4
Reference price	cents/kWh	12.0	12.0	12.0	12.0
Price increase (%)		*5%*	*7%*	*9%*	*12%*
Rural electricity (all diesel)					
Blended cost of allowances	cents/kWh	0.8	1.1	1.4	1.8
Reference price	cents/kWh	25.0	25.0	25.0	25.0
Price increase (%)		*3%*	*4%*	*6%*	*7%*

Source: ISER estimate. Uses the allowance price for distillate as a proxy for the allowance price per gallon of heavy (residual) oil. Railbelt blended cost of allowances based on a generation mix of: 69% natural gas, 5% coal, 13% hydro and 14% heavy oil.

This table shows that for Railbelt customers the increase in electric rates in 2030 would be about 1.4 cents per kWh, or 12% above the reference price, assuming no further changes in the reference price or the generation fuel mix. For rural customers who depend solely on diesel generation the allowance cost of 1.8 cents per kWh would be slightly higher in 2030, but the rate for a kWh would increase by only 7% above the baseline price because fuel is a smaller share of the total cost of electricity generation in rural areas. Since Southeast Alaska electric utility customers get 90+% of their electricity from hydro, they would see at most a 0.1 cent per kWh increase in rates.

Table 6 shows the potential increase in the total direct energy bill of an Anchorage household[5] due to increased prices for heating, transportation, and electricity. A typical Anchorage household might see an increase of roughly 5 to 10 percent of its overall energy bill over time. Again, this assumes a complete pass-through of allowance costs to the final consumer, as if there would be no consumer response to the higher prices.[6]

For other regions of Alaska both the absolute change and the percentage change in the household energy bill would probably be less. The absolute change would be less because

[5] This calculation does not include increased energy costs to business, which would be ultimately be absorbed by both producers and consumers.

[6] Although this assumption might seem plausible for a residential customer in the short run, it is much less plausible for commercial or industrial customers, and for all consumers if given the time to adjust their individual stocks of energy-using capital.

Anchorage households tend to use more energy. The percentage change would also be less because energy prices are higher outside of Anchorage so an equal amount of increase would equate to a smaller percentage increase. The aggregate statewide increase in household energy bills approaches $70 million per year in 2030.[7]

Table 6 Annual Direct Energy Bill for the Typical Anchorage Household: Full Pass Through of Allowance Costs (2004 dollars)

	2012	2020	2025	2030
Baseline prices				
Natural gas ($/mcf)	10.00	10.00	10.00	10.00
Electricity ($/kWh)	0.12	0.12	0.12	0.12
Gasoline ($/gal)	2.01	2.08	2.13	2.19
Baseline Anchorage energy bill				
natural gas	1,800	1,800	1,800	1,800
electricity	960	960	960	960
gasoline	1,611	1,661	1,707	1,750
Total	4,371	4,421	4,467	4,510
Increase with full pass-through of allowance costs:				
natural gas	99	147	187	239
electricity	47	69	88	112
gasoline	72	106	135	173
Total increase	218	322	411	524
Percent increase in energy bill	***5%***	***7%***	***9%***	***12%***

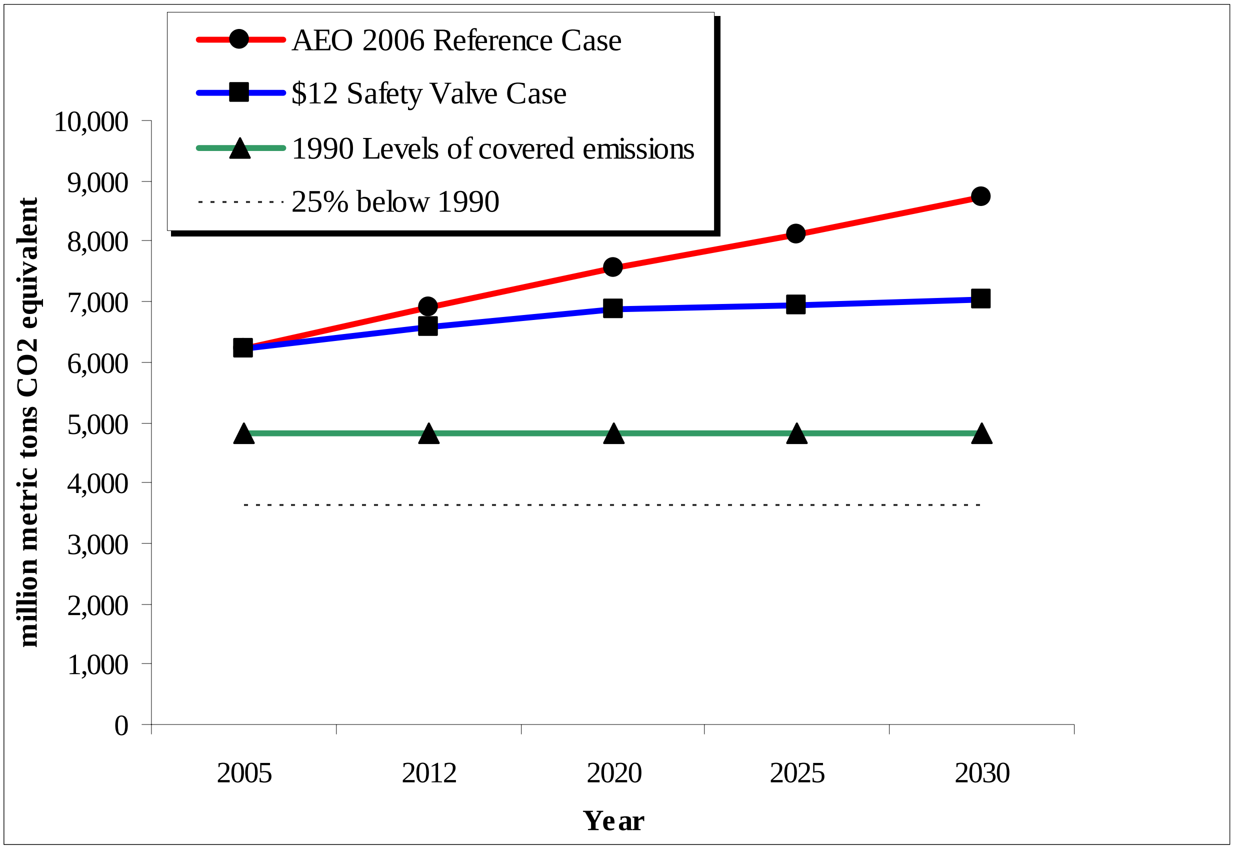
Source: ISER estimate. Note: Assumes average household consumption of 180 mcf/year of natural gas, 8,000 kWh/year of electricity, and 800 gal/year of gasoline.

Carbon Emissions Reductions

For perspective, the following figure shows projected greenhouse gas emissions under this proposal compared to some relevant benchmarks. The number for 1990 levels of emissions is the estimate of emissions covered by the proposed legislation.

[7] This calculation excludes indirect cost increases embedded in the cost of other goods and services. For example, increased freight charges on groceries.

Figure 1 Future Greenhouse Gas Emissions



Summary

Under the "$12 Safety Valve Case" analyzed here, the emissions allowances add between 10 and 20% to the cost of natural gas and petroleum products, while coal costs would roughly double.

These increases would be largely passed through to consumers in the form of higher market prices. The effects on Alaska "netback" oil and gas prices at the wellhead vary in this projection and are even more uncertain than projected market prices. This uncertainty is due mostly to underlying uncertainty about future costs and availability of alternatives such as nuclear and coal-with-capture.

Assuming a full pass-through of allowance prices, Alaska consumers would pay about 5% more for energy in 2012 and about 12% more in 2030. These increases would be lower on a percentage basis in rural Alaska, but the absolute dollar increases would be the same.