Alaska Fuel Price Projections 2008-2030

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Alaska Energy Authority

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Contents

Introduction

We generated Low, Medium, and High case fuel price projections for the years 2008-2030 for the following fuels:

- Incremental natural gas in Southcentral Alaska delivered to a utility-scale customer
- Incremental diesel delivered to a PCE community utility tank
- Incremental diesel delivered to a home in a PCE community
- Incremental home heating oil purchased in Anchorage, Fairbanks, Juneau, Kenai, Ketchikan, Palmer, and Wasilla

This memorandum provides documentation of the assumptions and methods that we used. Two companion Excel workbooks contain the detailed projections.

General methods and assumptions

Base year and time horizon

Our projections run from 2008 to 2030. They are computed and reported in inflation-adjusted year 2006 dollars, consistent with the EIA Annual Energy Outlook 2008. We recognize that a "projection" for 2008 is unlikely to match actual 2008 data. However, much of the data that we rely on has only been published through 2006 or 2007.

Ultra low sulfur diesel premium

We include a 5-cent additional cost starting in year 2008 for rural areas only, to account for the additional refining costs of ultra low sulfur diesel. This value can be quickly changed within the workbook

Carbon pricing

For the Low case, we assume that the cost of greenhouse gas allowances is zero.

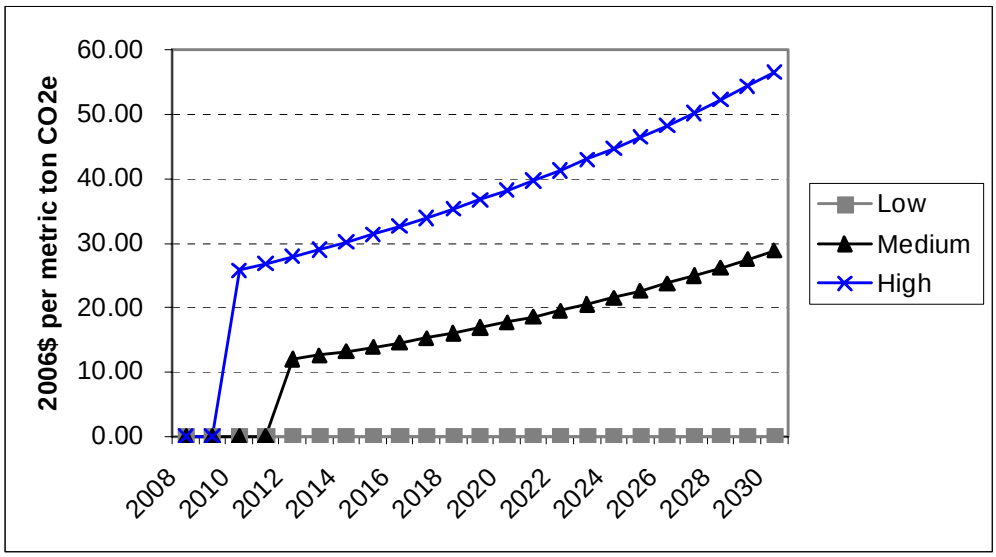
For the Medium case we assume that the price follows a trajectory broadly consistent with relatively lenient national policy such as that embodied in the Bingaman-Specter "Low Carbon Economy Act." This legislation requires cap-and-trade but contains a safety valve provision that caps the allowance price. While various versions of the bill have been generated, our scenario is

based on a maximum allowance price of about $10 per metric ton CO2-equivalent (in year 2006$) beginning in 2012 and rising 5% in real terms each year thereafter.

For the High case we have assumed an allowance price trajectory based on the MIT Future of Coal study.[1] The MIT group described their "High CO2 Cost" case as a $25 per metric ton CO2 allowance cost measured in 1997$, imposed in 2015 and increasing at 4% per year above inflation thereafter. We have adjusted the 1997$ for inflation through 2006 and also assumed that the price trajectory begins in 2010 at a lower level that passes through the MIT benchmark in year 2015.

Figure 1 summarizes the assumed carbon price trajectories.

Figure 1. Carbon price trajectories (year 2006$ per metric ton CO2)



Natural Gas

Background

Chugach Electric Association (CEA) has four locations where it generates electricity using natural gas: Beluga, Bernice Lake, International Airport Road, and Nikiski. Marathon provides all of the gas to Bernice Lake, International and Nikiski. Marathon also provides 40% of the gas to Beluga. ML&P, ConocoPhillips and Chevron provide 20% each of CEA's gas needs at Beluga.

Existing gas supply contracts specify a formula for determining the contract price. The price for each CEA contract is based on the same general formula with adjustments made on an individual

[1] Massachusetts Institute of Technology. 2007. The Future of Coal: Options for a Carbon-Constrained World. (March). Available at: http://web.mit.edu/coal/

contract basis. In developing these projections we used the basic CEA gas contract formula with no adjustments or added transportation costs.

Under the basic formula, the contract price of gas is determined by the inflation-adjusted, or "indexed", prices of fuel oil, natural gas and crude oil.

The contract price in $/mcf is:

$1.35

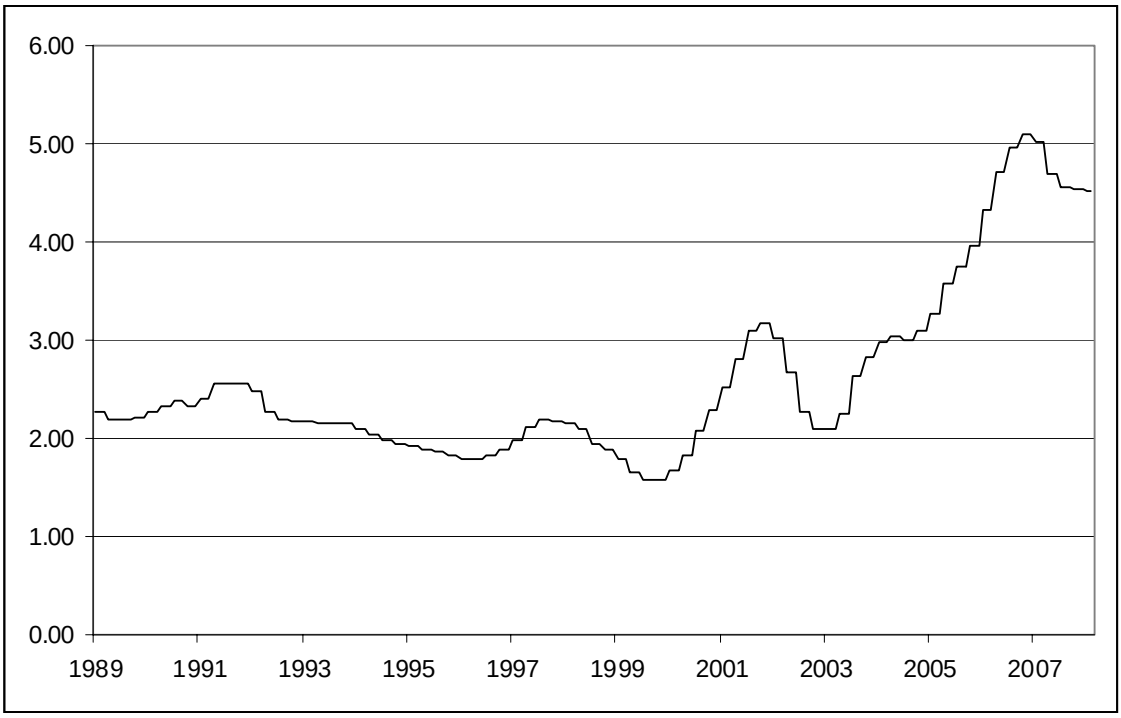
x {(reference natural gas – 84.54 ¢/mcf)/84.54

+ (reference fuel oil – 74.93 ¢/gallon)/74.93

+ (reference crude oil - $17.08 /barrel)/17.08}/3

The reference price for natural gas is the U.S. Bureau of Labor Statistics (BLS) Producer Price Index natural gas component index. The fuel oil reference price is the fuel oil component index of the BLS Consumer Price Index for all urban consumers (CPI-U). The crude oil reference price is the West Texas Intermediate (WTI) spot price traded on the New York Mercantile Exchange (NYMEX). The contract price is adjusted quarterly and the reference price of the 12 month average price lagged one quarter (the average of the months from 15 to 3 months previous. Figure 2 shows our estimates the historical price of CEA purchased gas using this formula.

Figure 2. CEA estimated historical gas purchase price (2006$ per mcf)



source: ISER estimates based on contract formula and formula inputs.

Key Assumptions

Assumption 1. Any project that offsets electric use on the Railbelt would offset Cook Inlet gas purchases. Chugach Electric is the marginal user of Cook Inlet natural gas. For this reason we assume that the cost of marginal or incremental gas is the price that Chugach pays and will pay for gas.

Assumption 2. All future contracts will be based on Henry Hub gas prices. As each existing contract expires it will be replaced by a new contract or an amended old contract based on Henry Hub prices. The Henry Hub price includes the transportation costs and taxes associated with moving the gas from the wellhead to Henry Hub so it is not necessary to add any further taxes or transportation costs to the Henry Hub price.

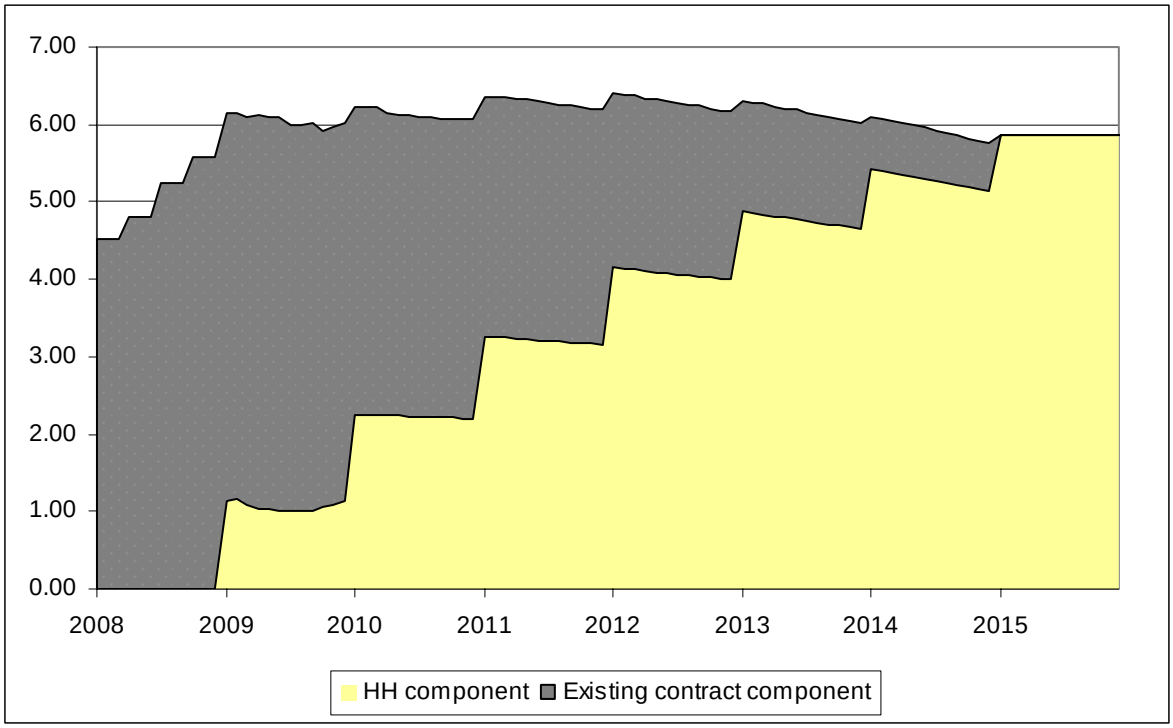
Assumption 3. In 2009 new contracts begin to come into use based on the Henry Hub price. By 2014 all gas contracts are based on the Henry Hub price. This is consistent with the method used in the CEA's Integrated Resource Plan[2].

Assumption 4. The fraction of total gas priced based on Henry Hub steadily increases from zero to 100 percent during the transition period from 1 January 2009 through 31 December 2014. Figure 3 illustrates this pattern for the Medium case.

Assumption 5. Absent compelling evidence for some other approach in a particular case, none of the pipeline transportation costs or local distribution costs are avoidable when considering Cook Inlet gas. Therefore no additional components are added to the price projection here.

[2] http://www.chugachelectric.com/news/projects/CEA_Integrated_Resource_Plan.pdf

Figure 3. Assumed shares of incremental gas supply from existing contract terms and from Henry Hub during contract transition phase, Medium case, (2006$ per mcf)



Projection method

1. Obtain the EIA Short-Term Energy Outlook (SEO) and the Annual Energy Outlook (AEO). These contain Low, Medium, and High projections of Henry Hub natural gas spot prices.

2. Convert EIA projections to appropriate base year real dollars, if necessary, using the CPI-U. For these projections we did not make any adjustment because the AEO 2008 numbers and our projections are both in year 2006 real dollars.

3-5. Project the base contract formula reference prices for natural gas, fuel oil, and crude oil to use during the 2009-2014 transition period:

3. The reference price for natural gas in the contract formula is the BLS PPI commodity price for natural gas. Since no forecast exists for this price, use the existing regression in the workbook that relates the PPI index value to the Henry Hub spot price, which is forecasted by the EIA. The short term price is forecasted using monthly forecasts from the SEO through the end of 2009. Since the SEO and the AEO forecasts do not line up perfectly at the beginning of 2010, we use a pro-rata formula that rolls in the AEO forecast over a 5 year period. There is only one set of projections provided in the AEO 2008 early release for these

4. The reference price for fuel oil in the contract formula is the CPI commodity price for fuel oil. Since no forecast exists for this price, use the existing regression coefficients in the workbook

that relate the CPI index value to the SEO forecast for residential heating oil (including taxes) and the AEO forecast for commercial distillate fuel. The SEO forecast is used to 2009 then is transitioned to the AEO forecast. There is only one set of projections provided in the AEO 2008 early release for this component, so the same numbers are used for this component in the Low, Medium, and High cases.

5. The reference price for crude oil is the WTI spot price. This price is forecasted in both the SEO and the AEO. The SEO is used to forecast through 2009 then the forecast is transitioned to the AEO forecast. There is only one set of projections provided in the AEO 2008 early release for this component, so the same numbers are used for this component in the Low, Medium, and High cases.

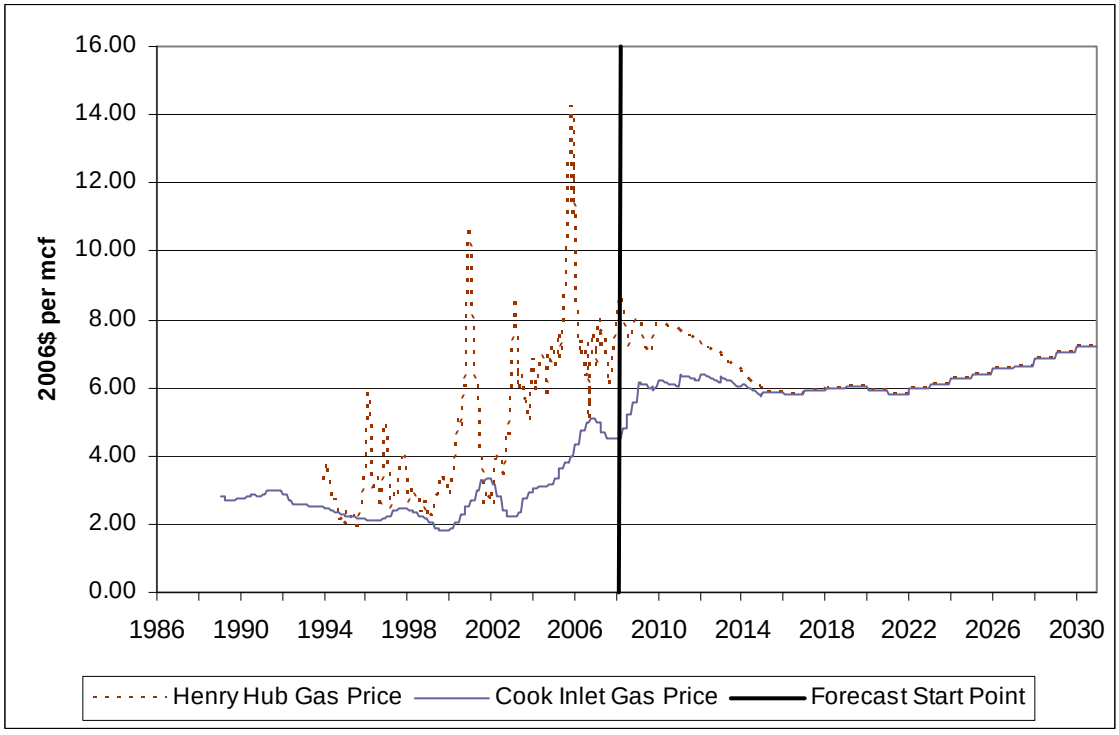
6. Apply a 6-year linear interpolation to slowly increase the weight on Henry Hub projected spot price and to decrease the weight on the projected "CEA contract" formula price during the years 2009 through 2014.

7. Beginning in 2015, use Henry Hub projected spot prices.

8. Add appropriate carbon prices to determine final projected price

Figure 4 shows the projected Medium case price for Cook Inlet natural gas using the above procedure. This graph does not include a carbon price in order to more clearly show how the Henry Hub and existing contract formula prices blend together during the transition period.

Figure 4. Cook Inlet gas price vs. Henry Hub gas price, Medium case, excluding carbon allowance cost ($2006 per mcf)



Fuel Oil

Background

Fuel oil prices are simpler (although not easier) to project because there are no existing complex contracts with formulas to be followed. Our projections are based on EIA AEO projections of crude oil. We use the Composite Refiner Acquisition Cost of crude oil (CORAC) as the basis for the fuel oil projections.

Key Assumptions

Assumption 1. The price of diesel to a particular PCE utility bears a stable linear relationship to the RAC crude price, but the coefficient is allowed to be different than 1.0 and is allowed to vary by community. A coefficient above 1.0 indicates "percentage markup pricing" as opposed to a straight pass-through of a crude price increase dollar for dollar.

Assumption 2. Due to uncertainties and ambiguities about the delivery points underlying the actual price data for "delivered" fuel oil, it is currently not possible to rigorously determine a home delivery surcharge by statistical methods. Instead, we suggest that $1.00 per gallon be used as the avoidable cost of home delivery when a substantial amount of delivered fuel is avoided (eg, a community district heating system or mass retrofit for biomass heating). However, when only small amounts of home-delivered fuel are being avoided, then we suggest that the appropriate credit for avoided delivery charges is zero.

Projection method

The fuel oil price projection is based on the imported crude oil price projection from EIA's Annual Energy Outlook (AEO). The mid price case is based on the AEO 2008 reference case, but because low and high crude oil price forecasts from AEO 2008 are not available at the time of this writing, AEO 2007 numbers were used to estimate low and high price cases for AEO 2008. In future updates, it is likely that AEO Low and High case prices will be available.

1. Obtain EIA's Annual Energy Outlook 2007 from the following URL:
http://www.eia.doe.gov/oiaf/archive/aeo07/

Obtain the forecast Imported Crude Oil Price from Table 1 for the reference, low price, and high price cases.

For each year, determine the ratio of the low price to the mid price and the ratio of the high price to the mid price.

2. Obtain EIA's Annual Energy Outlook 2008 from the following URL:
http://www.eia.doe.gov/oiaf/aeo/

Obtain the forecast Imported Crude Oil Price from Table 1 for the reference case.

For each year, multiply the AEO 2008 reference case price by the low-to-mid ratio for that year to produce a low price forecast, and by the high-to-mid ratio to produce a high price forecast.

3. Obtain the monthly "U.S. Crude Oil Imported Acquisition Cost by Refiners (Dollars per Barrel)" (CORAC) from the following URL:
http://tonto.eia.doe.gov/dnav/pet/pet_pri_rac2_dcu_nus_m.htm

Calculate average CORAC for Alaska fiscal years 2002 through 2007 by averaging the prices for months July (FY-1) through June (FY). Divide by 42 to obtain price per gallon.

3. Obtain the PCE Statistical Reports for fiscal years 2002 through 2007 from the following URL:
http://www.aidea.org/aea/programspce.html

4. Extract the field "Average Price of Fuel" for each community and year. Some communities without data require data from other communities as a proxy. The proxy communities suggested by AEA, listed with the original community first, then the proxy, are as follows:

- **For** Dot Lake: **Substitute**: Tok
- Hollis: Craig
- Klawock: Craig
- Thorne Bay/Kasaan: Craig
- Kasigluk: Nunapitchuk
- Pitkas Point: St. Mary's

Make the following additional substitutions:

- Chignik Lake: Chignik Lagoon
- Klukwan: Kake
- Kobuk: Shungnak
- Napakiak: Napaskiak

Perform these substitutions not by copying data points from the proxy community into the missing slots, but by copying the regression coefficients (calculated later) from the proxy community.

5. Adjust the CORAC FY averages and PCE fuel prices for inflation to 2006 dollars using the U.S. Consumer Price Index for All Urban Consumers (http://www.bls.gov/CPI/).

6. For each PCE community, do a linear regression with PCE fuel price per gallon as the dependent variable and CORAC per gallon as the independent variable, each year being one observation for that community consisting of a crude oil price and a heating oil price. (There are only six years of data for each community.)

7. Use the regression coefficients to predict fuel oil price per gallon for each PCE community as a function of Imported Crude Oil Price per gallon (Low, Mid, and High cases) for each year from 2008 to 2030.

8. The above prices are for utilities. For avoided use of home-delivered fuel, add $1/gal if a significant amount of fuel is avoided (no clear relationship was found between surveyed home

heating oil prices and PCE utility fuel prices, but the average difference was about $1.00). Do not add anything if only a small amount is avoided, as most of the costs of storage and delivery can only be avoided in "lumps."

9. For urban places (Anchorage, Fairbanks, Juneau, Kenai, Ketchikan, Palmer, Wasilla), obtain prices for heating oil from Alaska Housing Finance Corporation's annual fuel price surveys conducted in years 1999 through 2007 (contact ISER or AHFC to obtain this data). Use the average of #1 and #2 heating oil. Where prices are missing, use the price included in the Alaska Food Cost Survey conducted for December (http://www.uaf.edu/ces/fcs/) (there will still be some missing data points).

10. To obtain crude oil prices corresponding to the time frame of the heating oil prices, calculate the average CORAC per gallon for October through December of each year from 1999 to 2007 in nominal dollars.

11. For each place and year, subtract the average CORAC just calculated for that year from the fuel price for that place and year. Put this difference into real 2006 dollars using the same CPI as above. Put the average CORAC numbers in real 2006 dollars as well.

12. For each place, do a linear regression with the price difference as the dependent variable and CORAC as the independent variable, each year being one observation for that place consisting of a fuel-crude price difference and a crude oil price.

Use the regression coefficients to predict the difference between fuel price and CORAC for each place and year as a function of Imported Crude Oil Price per gallon (Low, Mid, and High cases) for each year from 2008 to 2030. Add to these the projected CORAC to obtain a projected heating oil price.

References

Massachusetts Institute of Technology. 2007. The Future of Coal: Options for a Carbon-Constrained World. (March). Available at: http://web.mit.edu/coal/