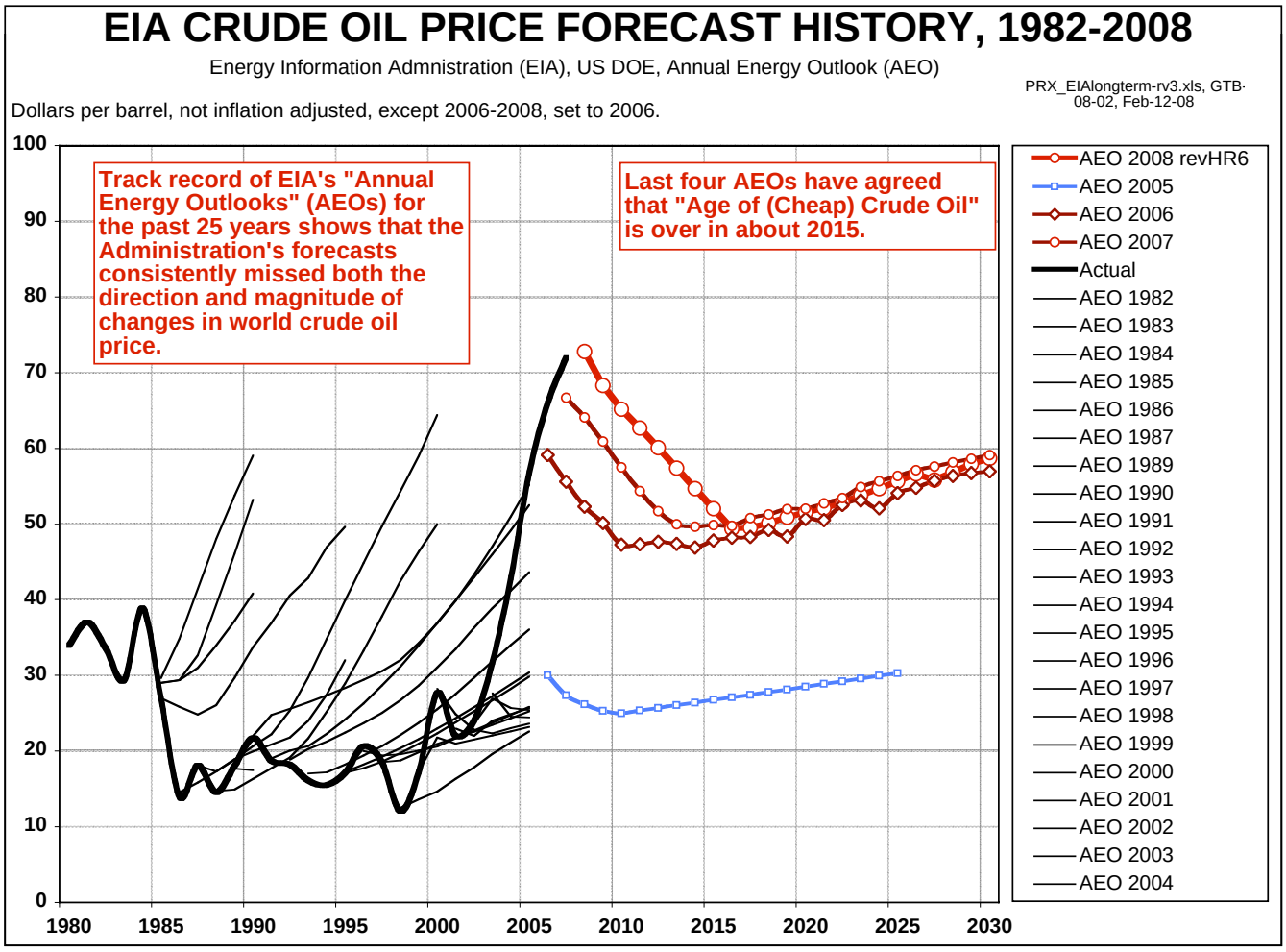
A Review of EIA's Annual Energy Outlook 2008 Revised to Reflect Energy Independence & Security Act of 2007

Bill Hudson, March 7, 2008

Each year in December, the US Department of Energy (DOE)—or more precisely, the Energy Information administration (EIA) within the DOE—publishes an *Annual Energy Review*, forecasting all the demand, supply, and price factors for the US energy sector for the next 25 years. I have carefully read the *Annual Energy Review* (AER) for several years, I have downloaded the main data tables in Excel, and I have also acquired (from the DOE website!) the track record of all their forecasts since 1985—which I have plotted below. To put it bluntly, but



entirely honestly, the DOE forecasts have been wrong virtually every year, and, taking the latest issue of AER into account, they show no signs of improving!

From the standpoint of business strategy, there are two important points to make about this tragic (or should I say "comedic") failure of DOE. First, it reminds me of a passage in the recent book on "The Science of Prediction" by David Orrell:

> "When the economist Kenneth Arrow was working as an air force weather forecaster during the Second World War, he and his colleagues found that their long-range weather predictions were no better than random. They informed the boss but were told, "The commanding general is well aware that the forecasts are no good. However, he needs them for planning purposes." (p. 301)

This quotation is clearly humorous, but my first point is that it contains great truth. We *know* we cannot forecast the future, but we *must* plan. Our solution to this dilemma is to *pretend* we can forecast, so we can get on with our planning. All of the branches of the US government will adopt the 2008 DOE energy forecast—calling for a decline in world crude oil price to the range of $60 per barrel in the coming few years—for bureaucratic planning purposes, for budgeting, and for executing standing legislation and regulations.

My second point has to do with the official method of (pretended) forecasting. Why is it taken for granted that teams of scientists (in this case economists) working with large computers represent the best means of predicting the future, when their 25-year track record shows they cannot do it? Their "batting average" is below .100. In baseball, these "scientists" could not make the minor leagues!

I do not of course expect that my objections here will make any difference to what the DOE does—but let me explain why I believe the DOE computers get the forecast so wrong. All mathematical models depend on their input for their output, as goes almost without saying. In the case of world crude oil price, the input data includes a period during the 1990s of very low crude oil prices, which is commonly characterized as a period when "OPEC crude oil capacity was well above world demand." This period is regarded as a "norm," to which the world will soon return after the present "anomaly" of high prices. But what if reality is the other way around? What if the 1990s period of low prices and "OPEC over-capacity" is the anomaly?

Personally, I interpret the low prices of the 1990s as both unusual and now "long gone." I think this period represents the last gasp of something I think of as "American Power." We had the power to "command" OPEC (especially Saudi Arabia) to keep oil price low. We no longer have this power. The reason is that the low prices themselves de-stabilized Arab society—they gave rise to the deep-seated resentments of Saudi Arabia's Osama bin Laden, and to his terrorist attacks on the US. Osama's successful attack on the Twin Towers in September, 2001, marks a change underlying the attitude of all Arab oil powers to the waning of American

Power. Let me repeat: The United States no longer has "world political hegemony." We can no longer obtain resources from around the world for less than their open market value, which we did for many decades of the 20th century, ending with the 1990s. In this absence of American power, why would any rational petroleum country return to deliberately and willingly managing their reserves from a stance of "surplus capacity"?

In my view, then, what the DOE model does is simply to "trend" the historical data in a straight line from the 1980s to the 2020s, as readers of this essay can all do with a plain ruler. This technique means that the low prices of the 1990s are "too low," and the high prices of the years 2004-2008 are "too high," and that in the future we can expect a "happy medium." This technique, as I have by now over-emphasized, leads to a DOE track record that is inaccurate, irresponsible, and regularly ignored by the business sector, though of course not by the other branches of government.

The PRX approach, as clients well know, is to *not* rely on a complex econometric model at all, but to play rather basic "What If?" games. Our current 10-year Blue Sky Model of US Corn and Soybeans asks the questions, "What if crude oil prices stay in the range of $95 per barrel over the coming years, what if the Energy Act of 2007 is executed as is, and what if the price of feed grains and oilseeds remain free to follow the wishes of both main markets, food and fuel?" (Our answer, by the way, is that the per bushel farm prices of the major grains and oilseeds are very likely to see a new era of highs, with corn in the range of $5 to $6 per bushel, and that the past 160-year period of cheap grain is "long gone." We are especially mindful of the dramatic impact which is likely in the wake of the next small corn crop, either from low planted area or from poor summer weather.)

Having vented all my objections to the DOE's AER2008 forecast, let me now elaborate some of the numbers from the model—so that readers may gauge for themselves whether the figures "make sense." Let me first explain one more thing about the DOE process: The department regularly finishes its annual review in December, for use by planners in the coming calendar year. This past December, 2007, the department finished its review on time, only to witness the passage of the Energy Independence and Security Act of 2007 on December 19th. In order to incorporate the new legislation in the 2008 AER, the DOE had to spend two more months modeling, and the revised results were released on March 4, 2008. It is this newest set of figures which I will summarize below.

For ease of treatment, let me speak of two periods, the years 2009-2015, and the years 2016-2022 (which is as far as the new Energy Act goes in increasing its Renewable Fuels Standard). The DOE forecast for 2009-2015 says that world crude oil price will decline and average $68 per barrel, down about $4 per barrel from their December outlook. In other words, the new Act will help reduce world crude oil price. For the same period, the pump price of gasoline in the US will average $2.45, up 9 cents from the December forecast. Ethanol wholesale price will average $1.87, up 15 cents from the December forecast. The differential between ethanol and wholesale motor fuel will about – 5 cents (that is 5 cents more than the 51 cent blenders tax credit), which was seen as –11 cents in the December outlook.

For the future years 2016-2022, DOE puts crude oil at an average of $59 per barrel (the figures are all in 2006 dollars), motor gasoline at a pump price of $2.30, and ethanol wholesale at $1.83, which is a differential of about + 9 cents to wholesale gasoline.

RENEWABLE FUEL STANDARD of Energy Independence and Security Act of 2007

US DOE FORECAST AER 2008 rev HR6 (Mar-08)

PRX_BlueSky_EISA2007_start, GTB-08-02, Feb-29-08

1	2	3	4	5	6	7	8	2 doe		3 doe	5 doe	9	10	11	12
Cal Year	Renewable Fuel Total	Conv Biofuel (I.e., corn starch) at least 20% GHG reduction 2010 and after	Advanced Biofuel at least 50% GHG reduction	Cellulosic Biofuel at least 60% GHG reduction	Advanced non-Cellulosic Biofuel (assume) at least 50% GHG reduction	Biobased Diesel at least 50% GHG reduction	Advanced non-Cellulosic non-Biodiesel Biofuel (assume) at least 50% GHG reduction	Renwbl Fuel Total	Net Imports	Conv Biofuel (I.e., corn starch)	Cellulosic Biofuel	Crude Oil (2006$)	Motor Gas Wholesale (PRX adjust from retail)	Ethanol Wholesale	Ethanol minus MoGas
	bil gal	bil gal	bil gal	bil gal	bil gal	bil gal	bil gal	bil gal	bil gal	bil gal	bil gal	$/bbl	cts/gal	cts/gal	cts/gal
2006	4.00	4.00													
2007	4.70	4.70													
2008	9.00	9.00						9.15	0.68	8.48	0.00	73	246	207	-39
2009	11.10	10.50	0.60			0.50		10.35	1.11	9.23	0.00	68	222	201	-21
2010	12.95	12.00	0.95	0.10	0.85	0.65	0.20	12.45	1.08	11.27	0.10	65	202	181	-22
2011	13.95	12.60	1.35	0.25	1.10	0.80	0.30	13.28	1.32	11.82	0.15	63	195	205	9
2012	15.20	13.20	2.00	0.50	1.50	1.00	0.50	13.58	1.10	12.32	0.15	60	188	205	17
2013	16.55	13.80	2.75	1.00	1.75	*1.00**	*0.75*	14.11	1.21	12.70	0.20	57	181	167	-14
2014	18.15	14.40	3.75	1.75	2.00	*1.00*	*1.00*	14.91	1.63	13.03	0.25	55	180	176	-4
2015	20.50	15.00	5.50	3.00	2.50	*1.00*	*1.50*	15.92	1.63	13.95	0.34	52	172	171	-1
2016	22.25	15.00	7.25	4.25	3.00	*1.00*	*2.00*	16.48	1.72	14.32	0.43	49	166	170	4
2017	24.00	15.00	9.00	5.50	3.50	*1.00*	*2.50*	17.30	1.80	14.87	0.63	49	168	168	1
2018	26.00	15.00	11.00	7.00	4.00	*1.00*	*3.00*	17.99	1.88	15.00	0.80	50	170	169	-1
2019	28.00	15.00	13.00	8.50	4.50	*1.00*	*3.50*	19.90	3.02	15.00	1.48	51	177	193	16
2020	30.00	15.00	15.00	10.50	4.50	*1.00*	*3.50*	21.59	3.73	15.00	2.71	52	183	201	18
2021	33.00	15.00	18.00	13.50	4.50	*1.00*	*3.50*	23.43	3.09	15.00	4.85	52	179	190	11
2022	36.00	15.00	21.00	16.00	5.00	*1.00*	*4.00*	26.09	3.36	15.00	7.24	53	181	192	11

***Minimum, with actual to be determined by joint review of EPA, DOE, and USDA.**

In other words, if the DOE is correct and world crude oil prices decline, then "all is well"—we will see the pump price of gasoline decline from today, and actually the basic need for alternative fuels such as ethanol to diminish. The table above shows the volumes of ethanol expected by the DOE in its March forecast. It has been much commented on that the department is not able to forecast "success" for cellulosic ethanol; details of why this might be so are not available in the DOE release to date, and may never be. Details as well of the department's assumption about US corn supply-demand are not available, but we see that the DOE expects ethanol *imports* of over 3 billion gallons by 2022. We note with especial regret that no scenario is mentioned in the entire 2009-2030 period of a poor crop of US corn. In other words, the nation, whose energy supply is now said by Congress to be more "independent and secure," will have well over 10 percent of its motor fuel completely dependent on the cornbelt weather every year, and the principal government agency who should be worried about this contingency, the DOE, is simply not worried.

One more bit of rosy outlook from DOE: The department assumes that the US economy will grow at the rate of 1.6 percent in 2008 (no recession, thank goodness!), followed by 2.6 percent in 2009, 3.3 percent in 2010, and then uninterrupted 2.5 percent or more growth through 2030. No mention is made of the strength of the dollar (or not), and its relation (or not) to crude oil price and other commodities such as corn. No mention is made of geopolitics, whether more or less intense in the Middle East.

Ethanol Price versus Gasoline: A Collision of Computers? With respect to the price differential of ethanol to wholesale gasoline mentioned above, let me introduce results from another "big computer model," that of the Center for Agricultural and Rural Development (CARD) at Iowa State University. In Working Paper 08-WP 460, Dermot Hayes and Bruce Babcock say that the mandates of the Energy Act of 2007 will only work with very high price differentials of ethanol to gasoline. Hayes and Babcock recognize that competition exists de facto among all classes of land for economic rents—there is NO LAND for energy crops that does not "interfere" with food crops. They say that due to this limited resource of land, and assuming crude oil price in the range of $70 per barrel, corn ethanol will need a subsidy of $0.22 to $0.78 per gallon, cellulosic (e.g., switchgrass) ethanol will need $1.55 to $2.11 per gallon, and biodiesel will need $1.97 to $2.90 per gallon. These "implicit subsidies" could be provided, we assume, by the federal government through public tax revenues, or they could be provided by prices at the pump, also paid by the public, and driven by regulatory methods promulgated by the EPA.

In the DOE's 2008 Annual Energy Review, no mention is made of "implicit subsidies" for ethanol, and the price differential of ethanol to gasoline is around 10 cents a gallon, even with low crude oil prices. It is not clear whether the 51 cent excise tax credit (an existing "implicit subsidy") will continue in the future. And no mention is made either of a separate price for cellulosic ethanol, even though the new Energy Act clearly calls for this—in its decree that advanced biofuels must be physically identifiable with a greater reduction of greenhouse gas emissions than corn ethanol.

As PRX clients and other participants in the current corn ethanol market are well aware, the present job of the ethanol price differential to gasoline has been to encourage greater actual *blending* of the product—that is, to cheapen ethanol's price versus gasoline, not to increase it. The argument of Iowa State computer team is that this job will reverse itself, perhaps when the US gasoline distribution system is fully "ready" for ethanol, but clearly the DOE disputes (or ignores) this argument in its long-term forecast.

Conclusion for Agribusiness Strategy. Neither the December nor the March versions of the DOE Annual Energy Review for 2008 provide credible guidelines of ethanol price and volume for commercial planners. The DOE forecasts have about a 10 percent chance of being accurate. PRX files will show the official figures for reference, but we will continue to offer "what if" games based on forward assumptions which seem to us more realistic.

STATEMENT OF GUY CARUSO, ADMINISTRATOR
ENERGY INFORMATION ADMINISTRATION
U.S. DEPARTMENT OF ENERGY
before the
Committee on Energy and Natural Resources
United State Senate
March 4, 2008

Selected Paragraphs

CRUDE OIL OUTLOOK.

In the AEO2008 reference case, real world crude oil prices (defined as the price of light, low-sulfur crude oil delivered in Cushing, Oklahoma, in 2006 dollars) decline gradually from current levels to $57 per barrel in 2016 ($68 per barrel in nominal dollars), as expanded investment in exploration and development brings new supplies to the world market. After 2016, real prices begin to rise (Figures 1 and 2), as demand continues to grow and higher cost supplies are brought to market. In 2030, the average real price of crude oil is $70 per barrel in 2006 dollars, or about $113 per barrel in nominal dollars. In developing its oil price outlook, EIA explicitly considered four factors: (1) growth in world liquids consumption, (2) the outlook for conventional oil production in countries outside the Organization of the Petroleum Exporting Countries (OPEC), (3) growth in unconventional liquids production, and (4) OPEC behavior. With the forces driving demand outside the United States as strong or stronger than previously expected and with global supply projections somewhat weaker, trends in total world liquids production are similar to those in the Annual Energy Outlook 2007 (AEO2007) reference case but the oil prices are higher.

RENEWABLE FUELS OUTLOOK

Total marketed renewable fuel consumption grows by an average of 3.0 percent per year in the reference case, from 6.8 quadrillion Btu in 2006 to 13.7 quadrillion Btu in 2030. About 45 percent of the demand for renewables in 2030 is for grid-related electricity generation (including combined heat and power), and the rest is for dispersed heating and cooling, industrial uses, or transportation uses. The rapid growth in the use of renewable fuels for transportation in AEO2008 reflects the updated RFS in Section 211(o) of the Clean Air Act as amended by EISA2007. The updated RFS sets a requirement for 36 billion gallons of total renewable fuels by 2022, including 21 billion gallons of advanced biofuels. Included are requirements for 1 billion gallons of biodiesel by 2012 and 16 billion gallons of cellulosic biofuels, both of which count toward the advanced biofuels requirement. The remaining 4 billion gallons of advanced biofuels may come from any source. The difference between advanced biofuels and total renewable fuels may be met by corn ethanol. Diesel fuels that are derived from biomass feedstocks count 1.5 times their physical volume as credits towards meeting the RFS requirements owing to die-

sel's higher energy content relative to ethanol.

While the situation is very uncertain, the current state of the industry and our present view of projected rates of technology development and market penetration of cellulosic biofuel technologies suggest that available quantities of cellulosic biofuels prior to 2022 will be insufficient to meet the new RFS targets for cellulosic biofuels, triggering both waivers and a modification of applicable volumes as provided for by paragraphs 7(D) and 7(F), respectively, of Section 211(o) of the Clean Air Act as amended by EISA2007. The modification of volumes reduces the overall target in 2022 from 36 billion gallons to 32.5 billion gallons. The modified cellulosic biofuel requirement is projected to be met by a combination of domestic cellulosic ethanol, imported cellulosic ethanol, and biomass-toliquids diesel, but the specific mix is again highly uncertain. Ethanol use grows from 5.6 billion gallons in 2006 to 24.3 billion gallons in 2030 (over16 percent of total gasoline consumption by volume) (Figure 7). Ethanol use for gasoline blending grows to 13.3 billion gallons and E85 consumption to 11.0 billion gallons in 2030. The ethanol supply is expected to be produced from both corn and cellulosic feedstocks, with corn accounting for 15.0 billion gallons of ethanol production in 2030. The AEO2008 reference case also expects strong growth in ethanol imports after 2010, reflecting the pending expiration of the tariff on imported ethanol in January 2009. Biodiesel use reaches 1.3 billion gallons in 2030 (about 1.6 percent of total diesel consumption by volume). Consumption of diesel liquids produced from biomass (BTL) grows to 4.2 billion gallons in 2030, 4.9 percent of total diesel consumption by volume.

Full statement at www.eia.doe.gov/olaf/aeo/index.htm.