

# **Comparison With Other Projections**

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Only IHS Global Insights, Inc. (IHSGI) produces a comprehensive energy projection with a time horizon similar to that of *AEO2010*. Other organizations, however, address one or more aspects of the U.S. energy market. The most recent projection from IHSGI, as well as others that concentrate on economic growth, international oil prices, energy consumption, electricity, natural gas, petroleum, and coal, are compared here with the *AEO2010* projections.

### Economic growth

Projections of the average annual growth rate of real GDP in the United States from 2008 to 2018 range from 2.1 percent to 2.8 percent (Table 9). In the *AEO2010* Reference case, real GDP grows by an average of 2.2 percent per year over the period, lower than projected by the Office of Management and Budget (OMB), the Congressional Budget Office (CBO), the Social Security Administration (SSA), and the Bureau of Labor Statistics (BLS)—although none of those projections has been updated since August 2009. The *AEO2010* projection is similar to the IHSGI projection and slightly higher than projections by the Interindustry Forecasting Project at the University of Maryland (INFORUM). In March 2009, the consensus Blue Chip projection was for 2.2-percent average annual growth from 2008 to 2018.

The range of GDP growth rates is wider for the recovery period from 2018 to 2030, with projections ranging from 2.2 to 2.7 percent per year. Uncertainty about the timing and speed of recovery from the current recession contributes to the wide range of

**Table 9. Projections of average annual economic growth rates, 2008-2035**

Projection	Average annual percentage growth rates		
	2008-2018	2018-2030	2030-2035
<i>AEO2009</i> (Reference case)	2.2	2.6	–
<i>AEO2010</i> (Reference case)	2.2	2.7	2.4
IHSGI (May 2009)	2.2	2.7	2.5
OMB (July 2009) <sup>a</sup>	2.8	–	–
CBO (August 2009) <sup>a</sup>	2.5	–	–
INFORUM (December 2009)	2.1	2.4	–
SSA (May 2009)	2.3	2.1	2.2
BLS (December 2009) <sup>a</sup>	2.4	–	–
IEA (2009) <sup>b</sup>	1.8	2.2	–
Blue Chip Consensus (March 2009)	2.2	–	–

<sup>a</sup>OMB and CBO projections end in 2019; BLS projection ends in 2018.

<sup>b</sup>IEA published U.S. growth rates for 2007-2015 (1.8 percent), 2015-2030 (2.2 percent), and 2007-2030 (2.1 percent).

– = not reported.

projections over the 2018-2030 period. The 2.7-percent average annual GDP growth rate in the *AEO2010* Reference case from 2018 to 2030 is on the higher side of the estimates but similar to the IHSGI projection. SSA, the International Energy Agency (IEA), and INFORUM project lower growth, as a result of their lower projections for labor productivity. *AEO2010* projects productivity increases averaging 2.1 percent per year from 2018 to 2030, as compared with the SSA and INFORUM projections of 1.7 and 1.6 percent per year, respectively, over the same period.

There are few public or private projections of GDP growth for the United States that extend to 2035. The *AEO2010* Reference case projects 2.4-percent average annual GDP growth, consistent with the trends in labor force and productivity growth. IHSGI projects GDP growth averaging 2.5 percent per year from 2008 to 2035, and INFORUM projects an average of 2.3 percent from 2008 to 2030 (the last year of the INFORUM projection). Both *AEO2010* and IHSGI project higher growth rates for productivity and labor force growth than does INFORUM.

### World oil prices

In the *AEO2010* Reference case, world oil prices rise from current levels to approximately \$95 per barrel in 2015 and \$108 per barrel in 2020 (Table 10). After 2020, prices increase slowly to \$133 per barrel in 2035. The price trend is slightly lower than in last year's (*AEO2009*) Reference case.

Market volatility and different assumptions about the future of the world economy are reflected in the range of price projections for both the short and long term. Most of the projections show prices rising throughout the entire period. The projections for world oil prices in 2030 range from \$65 per barrel to \$124 per barrel. The range of the other projections is encompassed in

**Table 10. Projections of world oil prices, 2015-2035 (2008 dollars per barrel)**

Projection	2015	2020	2025	2030	2035
<i>AEO2009</i> (Reference case)	112.91	117.99	124.62	133.29	–
<i>AEO2010</i> (Reference case)	94.52	108.28	115.09	123.50	133.22
INFORUM	92.50	107.98	109.74	116.81	–
DB	93.18	105.48	114.65	121.16	125.42
IHSGI	85.07	81.93	74.86	77.27	80.03
IEA (Reference)	–	100.00	–	115.00	–
EVA	80.35	84.45	90.98	100.45	–
SEER (Business-as-Usual)	79.20	74.31	69.73	65.43	–
SEER (Multi-Dimensional)	99.03	101.52	105.81	113.91	–

– = not reported.

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the range of the *AEO2010* Low and High Oil Price cases: from \$52 per barrel to \$204 per barrel in 2030 and from \$51 per barrel to \$210 per barrel in 2035.

The world oil price measures are, by and large, comparable across projections. EIA reports the price of imported low-sulfur, light crude oil, approximately the same as the West Texas Intermediate (WTI) prices that are widely cited as a proxy for world oil prices in the trade press. Deutsche Bank (DB), IHSGI, Energy Ventures Analysis, Inc. (EVA), and Strategic Energy & Economic Research, Inc. (SEER) report prices in WTI terms. IEA's *World Energy Outlook 2009* expresses prices as the IEA crude oil import price; INFORUM expresses prices as the average U.S. imported refiner acquisition cost of crude oil.

### Total energy consumption

Two of the projections, IHSGI and INFORUM, feature energy consumption by sector (although the INFORUM projection does not include data for 2008 and does not extend to 2035). Energy prices in the IHSGI projection are lower than those in the *AEO2010* Reference case. Prices in the INFORUM projections for crude oil, natural gas, and coal also are higher than in *AEO2010*, but electricity prices in the end-use sectors are at the same level (industrial and commercial) or lower (residential) than in the *AEO2010* Reference case. Both IHSGI and INFORUM project slower growth in energy consumption than in the *AEO2010* Reference case (Table 11).

Neither IHSGI nor INFORUM projects the introduction of Fischer-Tropsch fuels, nor do they include an accounting for the difference between the energy contained in biofuels and the energy contained in the biomass feedstock used in their production. When the *AEO2010* projections are adjusted for those two items (about 2.3 quadrillion Btu in 2030 and 3.1 quadrillion Btu in 2035), energy consumption in 2030 in the *AEO2010* Reference case is similar to that in the INFORUM projection, with differences of about 0.7 quadrillion Btu (lower) in the residential sector and about 0.7 quadrillion Btu (higher) in the electric power sector. For the residential sector, about one-half of the difference between the INFORUM and *AEO2010* Reference case projections is related to electricity consumption: INFORUM shows lower residential electricity prices but similar electricity prices in the industrial and commercial sectors. Total natural gas demand in the INFORUM projection is similar to that in the *AEO2010* Reference case, despite natural gas prices that are 50 to 80 cents per thousand cubic feet higher than in the *AEO2010* Reference case in 2020, 2025, and 2030.

Energy prices in the IHSGI projection generally are lower than those in the *AEO2010* Reference case. In the IHSGI projection for 2035, average natural gas wellhead prices are \$2.20 per thousand cubic feet lower, average delivered electricity prices are 7 mills per kilowatthour lower, coal prices to the electric power sector are about \$0.20 per million Btu lower,

**Table 11. Projections of energy consumption by sector, 2007-2035 (quadrillion Btu)**

Sector	2007			2008			2030			2035		
	<i>AEO-2010</i>	IN-FORUM	IHSGI	<i>AEO-2010</i>	IN-FORUM	IHSGI	<i>AEO-2010</i>	IN-FORUM	IHSGI	<i>AEO-2010</i>	IN-FORUM	IHSGI
Residential	11.3	11.3	10.8	11.3	-	10.9	11.9	12.6	11.8	12.1	-	11.9
Commercial	8.4	8.4	8.4	8.6	-	8.6	10.5	10.6	9.9	11.0	-	10.0
Industrial	25.2	-	-	24.8	-	-	26.1	-	-	26.7	-	-
Industrial excluding losses <sup>a</sup>	24.8	25.2	23.0	23.8	-	22.0	23.8	23.9	22.8	23.6	-	23.2
Transportation	29.0	28.9	28.6	27.8	-	27.3	31.3	31.0	29.1	32.5	-	30.6
Electric power	40.6	40.6	42.1	40.2	-	41.8	46.6	45.8	48.6	48.1	-	49.0
Less: electricity purchases <sup>b</sup>	12.8	12.8	12.8	12.7	-	12.8	15.3	15.3	15.8	15.9	-	16.3
<b>Total primary energy</b>	<b>101.7</b>	-	-	<b>100.1</b>	-	-	<b>111.2</b>	-	-	<b>114.5</b>	-	-
<b>Total primary energy excluding industrial losses <sup>a</sup></b>	<b>101.2</b>	<b>101.7</b>	<b>100.1</b>	<b>99.1</b>	-	<b>97.8</b>	<b>108.8</b>	<b>108.7</b>	<b>106.4</b>	<b>111.4</b>	-	<b>108.5</b>

- = not reported.

<sup>a</sup>Losses in CTL and biofuel production.

<sup>b</sup>Energy consumption in the end-use sectors includes electricity purchases from the electric power sector, which must be subtracted to avoid double counting in the derivation of total primary energy consumption.

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and light sweet crude oil prices are more than \$50 per barrel lower than in the *AEO2010* projection. When the energy contained in biofuels and biomass feedstocks (which is not included in the IHS&G projection) is subtracted from the *AEO2010* Reference case projections, overall demand is about 3 quadrillion Btu lower in the IHS&G projection, transportation sector demand is about 2 quadrillion Btu lower, commercial sector demand (mostly for natural gas) is about 1 quadrillion Btu lower, and there are smaller differences in the industrial and residential sectors that more than offset the difference of about 1 quadrillion Btu between the higher IHS&G projection and the *AEO2010* Reference case projection for energy consumption in the electric power sector.

### Electricity

Table 12 provides a summary of results from the *AEO2010* Reference case and compares them with other projections. For 2015, electricity sales range from a low of 3,870 billion kilowatthours in *AEO2010* to a high of 3,998 billion kilowatthours in the IHS&G projection. IHS&G shows higher sales in the residential and commercial sectors and slightly lower sales in the industrial sector. For 2035, electricity sales in the IHS&G projection are 4,734 billion kilowatthours, somewhat higher than the 4,660 billion kilowatthours in *AEO2010*. IHS&G projects higher residential and industrial sales and lower commercial sales of electricity in 2035.

The *AEO2010* Reference case shows declining real electricity prices after 2008, with rising prices near the end of the period, based on projected increases in fuel costs for generation and capital expenditures for construction of new capacity. The higher fossil fuel prices and capital expenditures in the *AEO2010* projection result in an increase in the average electricity price, from 8.9 cents per kilowatthour in 2015 to 10.2 cents per kilowatthour in 2035. IHS&G shows electricity prices declining from 2015 to 2035.

Total generation and imports of electricity in 2015 are higher in the IHS&G projection than in the *AEO2010* Reference case. The requirements for generating capacity are driven by growth in electricity sales and the need to replace existing units that are uneconomical or are being retired for various reasons. Consistent with its projections of electricity sales, IHS&G shows higher growth in generation and imports through 2015 in comparison with the *AEO2010* Reference case. For 2035, total generation and

imports are slightly lower in the IHS&G projection than in *AEO2010*. The two projections for nuclear power are similar, but those for generation from coal, oil, hydroelectric/other, and electricity imports all are lower, and the projection for natural gas is higher in the IHS&G projections than in the *AEO2010* Reference case.

The projections for generating capability in 2015 range from 1,032 gigawatts for IHS&G to 1,124 gigawatts for EVA, which shows more oil-fired and natural-gas-fired capacity than in the other projections. The IHS&G projections for hydroelectric/other capacity are lower than those from EVA and the *AEO2010* Reference case. The IHS&G and *AEO2010* projections of generating capability in 2035 are similar, except that IHS&G expects much less oil- and natural-gas-fired capacity than is projected in *AEO2010*. The *AEO2010* projection includes 4.0 gigawatts of uprates for nuclear capacity and expects all existing nuclear units to continue operating through 2035, based on the assumption that they will apply for and receive operating license renewals, including, in some cases, a second 20-year extension after they reach 60 years of operation. *AEO2010* also includes a second unit in 2014 at the Watts Bar site, where construction of a partially completed reactor was halted in 1988.

Environmental regulations are important determinants in the selection of electricity generation technologies. The *AEO2009* Reference case did not include the SO<sub>2</sub> and NO<sub>x</sub> cap-and-trade programs for power plants called for in the EPA's CAIR, because the Circuit Court for the District of Columbia had vacated CAIR in a July 2008 ruling. On December 23, 2008, the Court temporarily reinstated the rule, however, and it is represented in the *AEO2010* Reference case. *AEO2010* does not include the CAMR regulations, which were voided by the U.S. Court of Appeals in February 2008. Also, because *AEO2010* includes only current laws and regulations, it does not assume any cap or tax on CO<sub>2</sub> emissions. Restrictions on CO<sub>2</sub> emissions could change the mix of technologies used to generate electricity.

### Natural gas

The variation among projections of natural gas consumption, production, imports, and prices (Table 13) can be significant. This variation results from differences among the assumptions that underlie the different projection. For example, the *AEO2010* Reference case generally assumes that current laws

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**Table 12. Comparison of electricity projections, 2015 and 2035 (billion kilowatthours, except where noted)**

Projection	2008	AEO2010 Reference case	Other projections	
			IHSGI	EVA
<b>2015</b>				
<b>Average end-use price (2008 cents per kilowatthour)</b>	<b>9.8</b>	<b>8.9</b>	<b>9.6</b>	–
Residential	11.4	10.7	11.0	–
Commercial	10.4	9.1	10.1	–
Industrial	6.9	5.9	6.7	–
<b>Total generation plus imports</b>	<b>4,148</b>	<b>4,300</b>	<b>4,383</b>	–
Coal	1,995	2,037	2,070	–
Oil	45	46	46	–
Natural gas <sup>a</sup>	879	690	896	–
Nuclear	806	834	849	–
Hydroelectric/other <sup>b</sup>	391	672	504	–
Net imports	33	20	18	28
<b>Electricity sales</b>	<b>3,720</b>	<b>3,870</b>	<b>3,998</b>	–
Residential	1,379	1,400	1,512	–
Commercial/other <sup>c</sup>	1,359	1,473	1,517	–
Industrial	982	997	970	–
<b>Capability, including CHP (gigawatts) <sup>d</sup></b>	<b>1,008</b>	<b>1,069</b>	<b>1,032</b>	<b>1,124</b>
Coal	312	325	323	323
Oil and natural gas	454	442	446	510
Nuclear	101	105	106	106
Hydroelectric/other	141	198	157	186
<b>2035</b>				
<b>Average end-use price (2008 cents per kilowatthour)</b>	<b>9.8</b>	<b>10.2</b>	<b>9.5</b>	–
Residential	11.4	11.8	10.8	–
Commercial	10.4	10.4	9.9	–
Industrial	6.9	7.1	6.5	–
<b>Total generation plus imports</b>	<b>4,148</b>	<b>5,285</b>	<b>5,187</b>	–
Coal	1,995	2,305	2,244	–
Oil	45	49	32	–
Natural gas <sup>a</sup>	879	1,093	1,148	–
Nuclear	806	898	900	–
Hydroelectric/other <sup>b</sup>	391	915	851	–
Net imports	33	25	12	–
<b>Electricity sales</b>	<b>3,720</b>	<b>4,660</b>	<b>4,734</b>	–
Residential	1,379	1,707	1,809	–
Commercial/other <sup>c</sup>	1,359	1,937	1,831	–
Industrial	982	1,016	1,094	–
<b>Capability, including CHP (gigawatts) <sup>d</sup></b>	<b>1,008</b>	<b>1,216</b>	<b>1,082</b>	–
Coal	312	337	334	–
Oil and natural gas	454	531	399	–
Nuclear	101	113	116	–
Hydroelectric/other	141	236	233	–

<sup>a</sup>Includes supplemental gaseous fuels. For EVA, represents total oil and natural gas. <sup>b</sup>“Other” includes conventional hydroelectric, pumped storage, geothermal, wood, wood waste, municipal waste, other biomass, solar and wind power, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, petroleum coke, and miscellaneous technologies. <sup>c</sup>“Other” includes sales of electricity to government, railways, and street lighting authorities. <sup>d</sup>EIA capacity is net summer capability, including CHP plants. IHSGI capacity is nameplate, excluding cogeneration plants.

– = not reported.

Sources: **2008 and AEO2010:** AEO2010 National Energy Modeling System, run AEO2010R.D111809A. **IHSGI:** IHS Global Insight, Inc., *2009 Energy Outlook* (Lexington, MA, September 2009). **EVA:** Energy Ventures Analysis, Inc., *FUELCAST: Long-Term Outlook* (February 2010).

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and regulations will continue through the projection period as enacted, whereas some of the other projections assume the enactment of new public policy over the next 25 years. For example, the results of the Altos projection reflect the inclusion of carbon mitigation legislation.

All but two of the projections (Altos and EVA) show an initial decline and subsequent increase in natural gas consumption from 2008 levels, but they differ in terms of when, between 2015 and 2025, 2008 levels

are regained. The INFORUM projection for 2015 is 1.2 to 2.1 trillion cubic feet lower than the others but recovers quickly by 2025. With the exception of the SEER projection, which shows a decline in natural gas consumption from 2025 to 2030, total natural gas consumption grows in spite of increasing prices in the later years of all the projections. Altos and EVA show natural gas consumption exceeding 2008 levels by 2010 and continuing to increase at much more rapid rates than in the other projections.

**Table 13. Comparison of natural gas projections, 2015, 2025, and 2035 (trillion cubic feet, except where noted)**

Projection	2008	AEO2010 Reference case	Other projections					
			IHSGI	EVA	DB	SEER	Altos	INFORUM
<b>2015</b>								
<b>Dry gas production<sup>a</sup></b>	<b>20.56</b>	<b>19.29</b>	<b>22.63</b>	<b>24.47</b>	<b>19.29</b>	<b>20.01</b>	<b>19.19</b>	<b>19.71</b>
<b>Net imports</b>	<b>2.95</b>	<b>2.38</b>	<b>2.43</b>	<b>4.84</b>	–	<b>2.73</b>	<b>3.79</b>	<b>4.12</b>
Pipeline	2.65	1.29	1.62	2.65	–	1.83	0.47	–
LNG	0.30	1.09	0.81	2.19	3.48	0.90	3.32	–
<b>Consumption</b>	<b>23.25</b>	<b>21.74</b>	<b>22.63</b>	<b>24.84</b>	–	<b>22.80</b>	<b>24.18<sup>b</sup></b>	<b>18.86<sup>b</sup></b>
Residential	4.87	4.71	4.71	5.07	–	4.87	4.75	4.76
Commercial	3.12	3.23	3.05	3.21	–	3.14	3.18	3.16
Industrial <sup>c</sup>	6.65	6.88	6.24	6.84	–	6.23	6.41	6.35
Electricity generators <sup>d</sup>	6.66	5.18	6.74	7.62	–	6.73	9.83	4.60
Other <sup>e</sup>	1.95	1.73	1.90	2.09	–	1.84	–	–
<b>Lower 48 wellhead price (2008 dollars per thousand cubic feet)<sup>f</sup></b>	<b>8.07</b>	<b>5.70</b>	<b>5.73</b>	<b>6.40</b>	<b>5.77</b>	<b>5.34</b>	<b>6.06</b>	–
<b>End-use prices (2008 dollars per thousand cubic feet)</b>								
Residential	13.87	11.89	12.15	–	–	12.26	–	–
Commercial	12.29	10.28	10.51	–	–	11.08	–	–
Industrial <sup>g</sup>	9.38	6.63	8.01	–	–	7.11	–	–
Electricity generators	9.34	6.24	6.44	–	–	6.70	–	–
<b>2025</b>								
<b>Dry gas production<sup>a</sup></b>	<b>20.56</b>	<b>21.31</b>	<b>21.91</b>	<b>24.41</b>	<b>20.63</b>	<b>22.30</b>	<b>27.23</b>	<b>20.93</b>
<b>Net imports</b>	<b>2.95</b>	<b>2.17</b>	<b>2.34</b>	<b>2.89</b>	–	<b>2.18</b>	<b>3.67</b>	<b>5.77</b>
Pipeline	2.65	0.89	1.42	2.52	–	1.25	-1.42	–
LNG	0.30	1.28	0.92	0.37	2.65	0.93	5.09	–
<b>Consumption</b>	<b>23.25</b>	<b>23.57</b>	<b>24.22</b>	<b>27.84</b>	–	<b>24.35</b>	<b>27.72<sup>b</sup></b>	<b>21.82<sup>b</sup></b>
Residential	4.87	4.89	4.62	5.16	–	4.90	4.85	4.86
Commercial	3.12	3.45	3.06	3.28	–	3.41	3.33	3.24
Industrial <sup>c</sup>	6.65	6.94	6.34	7.55	–	6.55	6.47	6.93
Electricity generators <sup>d</sup>	6.66	6.28	8.12	9.49	–	7.51	13.08	6.81
Other <sup>e</sup>	1.95	2.00	2.07	2.36	–	1.99	–	–
<b>Lower 48 wellhead price (2008 dollars per thousand cubic feet)<sup>f</sup></b>	<b>8.07</b>	<b>6.35</b>	<b>5.87</b>	<b>7.31</b>	<b>8.42</b>	<b>5.90</b>	<b>7.01</b>	–
<b>End-use prices (2008 dollars per thousand cubic feet)</b>								
Residential	13.87	12.65	12.08	–	–	12.96	–	–
Commercial	12.29	11.01	10.49	–	–	11.87	–	–
Industrial <sup>g</sup>	9.38	7.22	8.10	–	–	7.70	–	–
Electricity generators	9.34	6.94	6.57	–	–	8.87	–	–

– = not reported. See notes and sources at end of table.

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For the residential and commercial sectors, natural gas consumption patterns are similar across the projections, with the exception of IHSGI, which shows a decline in residential consumption and commercial consumption that remains below the 2008 level through 2035. Excluding IHSGI, the average annual rate of growth in residential natural gas consumption from 2008 to 2025 ranges from almost no growth to 0.5 percent, and the average for commercial natural gas consumption varies from 0.2 percent (INFORUM) to 0.6 percent (*AEO2010*).

Three of the six projections (EVA, INFORUM, and the *AEO2010* Reference case) show industrial natural gas consumption returning to 2008 levels or higher by 2015. In the *AEO2010* projection, industrial natural gas consumption exceeds 2008 levels in 2015, because industrial natural gas prices are relatively low, and there is a significant increase in the use of natural gas

at refineries for biofuel production. The *AEO2010* Reference case and EVA projections show the strongest short-term growth in industrial natural gas consumption, averaging 0.5 percent per year from 2008 to 2015.

The differences among the projections for natural gas consumption in the electric power sector can be attributed to two primary factors: assumptions about carbon mitigation legislation and assumptions about the costs and availability of hydroelectric and other renewable energy resources. The *AEO2010* Reference case and INFORUM projections are the lowest, and they are the only ones in which the sector's consumption of natural gas in 2015 is lower than in 2008 (in the *AEO2010* Reference case, as a result of slow growth in electricity demand, completion of planned new coal-fired capacity, and construction of new renewable capacity in response to incentives and RFS

**Table 13. Comparison of natural gas projections, 2015, 2025, and 2035 (continued)**  
(trillion cubic feet, except where noted)

Projection	2008	<i>AEO2010</i> Reference case	Other projections					
			IHSGI	EVA	DB	SEER	Altos	INFORUM
<b>2035</b>								
<b>Dry gas production<sup>a</sup></b>	<b>20.56</b>	<b>23.27</b>	<b>23.02</b>	–	<b>18.44</b>	–	<b>32.72</b>	–
<b>Net imports</b>	<b>2.95</b>	<b>1.46</b>	<b>1.84</b>	–	–	–	<b>1.70</b>	–
Pipeline	2.65	0.64	0.92	–	–	–	-4.46	–
LNG	0.30	0.83	0.92	–	3.91	–	6.16	–
<b>Consumption</b>	<b>23.25</b>	<b>24.86</b>	<b>24.84</b>	–	–	–	<b>30.48<sup>b</sup></b>	–
Residential	4.87	4.87	4.45	–	–	–	4.85	–
Commercial	3.12	3.69	3.05	–	–	–	3.50	–
Industrial <sup>c</sup>	6.65	6.72	6.37	–	–	–	6.42	–
Electricity generators <sup>d</sup>	6.66	7.42	8.81	–	–	–	15.72	–
Other <sup>e</sup>	1.95	2.17	2.16	–	–	–	–	–
<b>Lower 48 wellhead price (2008 dollars per thousand cubic feet)<sup>f</sup></b>	<b>8.07</b>	<b>8.06</b>	<b>5.87</b>	–	<b>9.91</b>	–	<b>7.89</b>	–
<b>End-use prices (2008 dollars per thousand cubic feet)</b>								
Residential	13.87	14.82	11.85	–	–	–	–	–
Commercial	12.29	13.03	10.31	–	–	–	–	–
Industrial <sup>g</sup>	9.38	8.99	8.05	–	–	–	–	–
Electricity generators	9.34	8.69	6.54	–	–	–	–	–

– = not reported.

<sup>a</sup>Does not include supplemental fuels. <sup>b</sup>Does not include natural gas use as fuel for lease and plants, pipelines, or natural gas vehicles.

<sup>c</sup>Includes consumption for industrial CHP plants, a small number of electricity-only plants, and GTL plants for heat and power production.

<sup>d</sup>Includes consumption of energy by electricity-only and CHP plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes electric utilities, small power producers, and exempt wholesale generators. <sup>e</sup>Includes lease, plant, and pipeline fuel and fuel consumed in natural gas vehicles. <sup>f</sup>2008 wellhead natural gas price for SEER is \$7.65 per thousand cubic feet. <sup>g</sup>The 2008 industrial natural gas price for IHSGI and SEER are \$10.30 and \$9.80 per thousand cubic feet, respectively.

Sources: **2008 and AEO2010:** AEO2010 National Energy Modeling System, run AEO2010R.D111809A. **IHSGI:** IHS Global Insight, Inc., *2009 U.S. Energy Outlook* (September 2009). **EVA:** Energy Ventures Analysis, Inc., *FUELCAST: Long-Term Outlook* (February 2010).

**DB:** Deutsche Bank AG, e-mail from Adam Sieminski (November 3, 2009). **SEER:** Strategic Energy and Economic Research, Inc., "Natural Gas Outlook" (November 2009). **Altos:** Altos World Gas Trade Model (October 2009). **INFORUM:** INFORUM Base, e-mail from Douglas Meade (January 15, 2010).

## Comparison with Other Projections

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programs at the State level). The highest level of natural gas consumption in the electric power sector is in the Altos projection, ranging from 29 percent to 114 percent above the other projections for 2015 and 38 percent to 108 percent above the others for 2025.

The natural gas supply projections from Altos and EVA differ significantly from the other projections, in part because of higher consumption levels. In addition, however, Altos also has a very different outlook for net pipeline imports of natural gas. Whereas the other projections show declines in pipeline imports, Altos has a more aggressive outlook, projecting that the United States will become a net exporter by 2020, and that U.S. pipeline exports will total 4.5 trillion cubic feet in 2035. As a result, the requirements for additional supply from domestic production and LNG imports in the Altos projection are significantly greater than those in the other projections.

Wellhead natural gas prices in the Altos projection are higher than those in the other projections, with the exception of DB, but the differences are not proportional to the differences in domestic production. Three of the seven projections (*AEO2010* Reference case, IHSGI, and SEER) present relatively similar outlooks for supply sources, with domestic production providing a growing percentage of total natural gas supply over the projection period (with very similar percentages). The *AEO2010* Reference case, IHSGI, and SEER also show a decline in net pipeline imports of natural gas, but net imports remain positive over the entire projection period, with growth in LNG imports to about 1 trillion cubic feet. The same three projections also show generally lower natural gas prices than the others, indicating a generally more optimistic view of domestic natural gas supply potential. In contrast, EVA, DB, and Altos project greater reliance on net LNG imports, at 2.2 trillion cubic feet per year and above. The DB wellhead natural gas prices are the highest among the projections shown in Table 13, reflecting a more pessimistic view of the potential for future domestic natural gas production.

Price margins for delivered natural gas (defined as the difference between delivered and wellhead natural gas prices) reflect average transportation and delivery charges, as well as differences in what each sector pays for natural gas at the supply point. Only the *AEO2010* Reference case, IHSGI, and SEER include projections for delivered natural gas prices. For the residential and commercial sectors, IHSGI projects an increase in margins over their 2008 levels,

followed by a decline. The *AEO2010* Reference case and SEER project continued increases in residential and commercial margins over the projection period. In the *AEO2010* Reference case, the increases result largely from a decline in natural gas consumption per customer, which increases the per-unit-equivalent charge for the fixed component of customers' gas bills.

End-use natural gas prices in the industrial sector are difficult to compare because of apparent definitional differences between the projections, which are obvious from a comparison of 2008 prices in the different projections. In the IHSGI and SEER projections, industrial natural gas prices in 2008 are, respectively, \$0.93 and \$0.43 (2008 dollars) per thousand cubic feet higher than in the *AEO2010* Reference case, implying some difference in the definition of industrial natural gas prices (the definitions were not available to EIA). The projected industrial margins remain relatively stable in the IHSGI, SEER, and *AEO2010* projections, but they differ significantly: the average industrial margins for IHSGI and SEER are \$1.32 and \$0.87 per thousand cubic feet higher, respectively, than the average industrial margin in the *AEO2010* Reference case.

The *AEO2010* Reference case and IHSGI margins for the electric power sector are more similar, with IHSGI showing slightly higher average margins consistent with the difference in the margins for 2008. In the SEER projections, natural gas margins for the electric power sector decline in the near term from their 2008 level of \$1.60 per thousand cubic feet (2008 dollars), then increase rapidly after 2013, exceeding SEER's industrial margin after 2018 and climbing to \$4.05 per thousand cubic feet in 2030. In the *AEO2010* Reference case and IHSGI projections, margins in the electric power sector also decline quickly after 2008, but they remain considerably lower than their 2008 levels, reaching a maximum of \$0.64 per thousand cubic feet (2008 dollars) in 2029 in the *AEO2010* Reference case and \$0.72 per thousand cubic feet (2008 dollars) in 2015 in the IHSGI projection.

### Liquid fuels

In the *AEO2010* Reference case, the world oil price is assumed to be \$95 per barrel in 2015, \$115 in 2025, and \$133 in 2035 (see Table 10). This price projection is similar to DB's price projection for WTI (\$93 per barrel in 2015, \$115 in 2025, and \$125 in 2035). EVA, IHSGI, and Purvin and Gertz, Inc. (P&G) project much lower crude oil prices.



## Comparison with Other Projections

**Table 14. Comparison of liquids projections, 2015, 2025, and 2035  
(million barrels per day, except where noted)**

Projection	2008	AEO2010 Reference case	Other projections				
			IHSGI	EVA	DB	P&G	IEA
<b>2015</b>							
<b>Crude oil and NGL production</b>	<b>6.75</b>	<b>7.54</b>	<b>6.50</b>	<b>8.14</b>	<b>6.60</b>	<b>6.11</b>	–
Crude oil	4.96	5.77	4.75	–	4.95	4.36	4.70
Natural gas liquids	1.78	1.77	1.75	–	1.65	1.75	–
<b>Total net imports</b>	<b>11.14</b>	<b>10.12</b>	<b>10.42</b>	–	<b>10.40</b>	<b>11.58</b>	–
Crude oil	9.75	8.88	9.68	–	–	11.80	–
Petroleum products	1.39	1.24	0.74	–	–	-0.22	–
<b>Petroleum demand</b>	<b>19.52</b>	<b>20.18</b>	<b>19.29</b>	–	<b>18.65</b>	<b>18.21</b>	<b>17.90</b>
Motor gasoline	8.99	9.37	8.56	–	8.97	8.96	–
Jet fuel	1.54	1.57	1.58	–	1.40	1.62	–
Distillate fuel	3.94	4.08	4.08	–	3.61	4.14	–
Residual fuel	0.62	0.66	0.61	–	0.54	0.57	–
Other	4.43	4.49	4.45	–	–	2.92	–
<b>Net import share of petroleum demand (percent)</b>	<b>62</b>	<b>57</b>	<b>54</b>	–	–	<b>64</b>	–
<b>2025</b>							
<b>Crude oil and NGL production</b>	<b>6.75</b>	<b>7.87</b>	<b>5.76</b>	<b>7.16</b>	<b>5.39</b>	<b>4.86</b>	–
Crude oil	4.96	6.13	3.87	–	4.04	3.24	–
Natural gas liquids	1.78	1.74	1.90	–	1.35	1.62	–
<b>Total net imports</b>	<b>11.14</b>	<b>9.70</b>	<b>11.19</b>	–	<b>10.70</b>	<b>12.03</b>	–
Crude oil	9.75	8.60	10.57	–	–	12.30	–
Petroleum products	1.39	1.10	0.62	–	–	-0.27	–
<b>Petroleum demand</b>	<b>19.52</b>	<b>20.63</b>	<b>20.38</b>	–	<b>17.51</b>	<b>18.07</b>	–
Motor gasoline	8.99	9.32	7.80	–	8.32	7.79	–
Jet fuel	1.54	1.75	1.98	–	1.36	1.81	–
Distillate fuel	3.94	4.41	5.23	–	3.34	4.70	–
Residual fuel	0.62	0.66	0.61	–	0.50	0.58	–
Other	4.43	4.50	4.75	–	–	3.19	–
<b>Net import share of petroleum demand (percent)</b>	<b>62</b>	<b>55</b>	<b>55</b>	–	–	<b>67</b>	–
<b>2035</b>							
<b>Crude oil and NGL production</b>	<b>6.75</b>	<b>8.11</b>	<b>5.06</b>	–	<b>4.29</b>	–	–
Crude oil	4.96	6.27	3.07	–	3.22	–	–
Natural gas liquids	1.78	1.83	1.99	–	1.07	–	–
<b>Total net imports</b>	<b>11.14</b>	<b>9.66</b>	<b>13.31</b>	–	<b>9.50</b>	–	–
Crude oil	9.75	8.65	11.72	–	–	–	–
Petroleum products	1.39	1.02	1.59	–	–	–	–
<b>Petroleum demand</b>	<b>19.52</b>	<b>20.86</b>	<b>21.81</b>	–	<b>15.18</b>	–	–
Motor gasoline	8.99	9.06	7.33	–	6.80	–	–
Jet fuel	1.54	1.84	2.29	–	1.29	–	–
Distillate fuel	3.94	4.91	6.56	–	2.95	–	–
Residual fuel	0.62	0.67	0.59	–	0.44	–	–
Other	4.43	4.37	5.05	–	–	–	–
<b>Net import share of petroleum demand (percent)</b>	<b>62</b>	<b>54</b>	<b>61</b>	–	–	–	–

– = not reported.

Sources: **2008 and AEO2010:** AEO2010 National Energy Modeling System, run AEO2010R.D111809A. **IHSGI:** IHS Global Insight, Inc., *2009 Energy Outlook* (Lexington, MA, September 2009). **EVA:** Energy Ventures Analysis, Inc., *FUELCAS: Long-Term Outlook* (February 2010). **DB:** Deutsche Bank AG, e-mail from Adam Sieminski (November 3, 2009). **P&G:** Purvin and Gertz, Inc., *2009 Global Petroleum Market Outlook*, Vol. 2, Table III-2 (April 2009). **IEA:** International Energy Agency, *World Energy Outlook 2009* (Paris, France, November 2009), Table 1.4.

## Comparison with Other Projections

A major difference between the *AEO2010* Reference case and all but the EVA projection is that the *AEO2010* projects much higher domestic crude oil production throughout the projection (Table 14). In addition, domestic production of crude oil increases gradually over time in the *AEO2010* projection, whereas all the other projections show rapid decreases in domestic production. As a consequence, the *AEO2010* Reference case shows lower net imports of crude oil.

Overall petroleum product demand in the *AEO2010* Reference case is similar to that in the IHSGI projection but higher than those in the EVA, DB, P&G, and IEA projections. The IHSGI projection shows a higher ratio of distillate to motor gasoline consumption than in the *AEO2010* Reference case, however, especially in 2035, implying more distillate use than in the *AEO2010* projection.

*AEO2010*, IHSGI, DB, and P&G all show motor gasoline demand decreasing in absolute terms. For *AEO2010*, the decline in motor gasoline demand is the result of increased efficiency, tighter CAFE standards, and increased use of ethanol. All four projections also show increasing ratios of distillate fuel to motor gasoline consumption.

In the *AEO2010* Reference case, demand for jet fuel increases at a gradual pace, averaging 0.8 percent per year from 2015 to 2035. In the IHSGI projection, jet fuel demand is at the same level as in the *AEO2010* in 2015 but increases at a faster pace, averaging just under 1.9 percent per year from 2015 to 2035. In the DB projection, jet fuel demand gradually decreases over time, by 0.4 percent per year on average from 2015 to 2035.

### Coal

The outlook for coal markets varies considerably across the projections compared in Table 15. Differences in assumptions about expectations for and implementation of legislation aimed at reducing GHG emissions can lead to significantly different projections for coal production, consumption, and prices. In addition, different assumptions about world oil prices, natural gas prices, and economic growth can contribute to variation across the projections.

In the *AEO2010* Reference case, total U.S. coal consumption increases from 1,122 million tons (22.4

quadrillion Btu) in 2008 to 1,235 million tons (23.6 quadrillion Btu) in 2025 and 1,319 million tons (25.1 quadrillion Btu) in 2035. Total coal consumption also increases in the IEA projection, to 22.7 quadrillion Btu in 2025. Total coal consumption decreases in both the IHSGI and DB projections to 1,095 million tons and 21.9 quadrillion Btu, respectively, in 2025 and to 1,086 million tons and 20.8 quadrillion Btu, respectively, in 2035.

In the *AEO2010* projection, coal production increases from 1,172 million tons (23.9 quadrillion Btu) to 1,234 million tons (24.4 quadrillion Btu) in 2025 and to 1,285 million tons (25.2 quadrillion Btu) in 2035. INFORUM projects a larger increase in coal production, to 1,465 million tons in 2025. In the Wood Mackenzie Company (WM) projection, production (excluding coking coal) remains relatively constant, increasing to 1,180 million tons in 2025. In the IHSGI projection, coal production falls to 1,109 million tons in 2025 and 1,098 million tons in 2035.

U.S. coal exports decline from 82 million tons in 2008 to 48 million tons in 2025 in the *AEO2010* Reference case, and coal imports increase slightly from 32 million tons in 2008 to 34 million tons in 2025. In contrast to the other projections, *AEO2010* projects that the United States eventually will become a net importer of coal. U.S. coal exports fall to 33 million tons in 2035 in the *AEO2010* Reference case, and coal imports increase to 53 million tons. INFORUM projects an increase in exports to 161 million tons, as well as an increase in imports to 43 million tons, in 2025. In the WM projection, both exports and imports (excluding coking coal) fall to 26 million tons in 2025. IHSGI projects a decrease in exports to 49 million tons in 2025 and to 45 million tons in 2035, with little change in coal imports, which total 35 million tons in 2025 and 33 million tons in 2035.

Minemouth coal prices in the *AEO2010* Reference case decline from \$31.26 per ton (\$1.55 per million Btu) in 2008 to \$28.19 per ton (\$1.44 per million Btu) in 2025 and remain relatively constant thereafter, with a price of \$28.10 per ton (\$1.44 per million Btu) projected for 2035. In the IHSGI projection, the average minemouth coal price falls to \$26.08 per ton in 2025 and \$25.81 per ton in 2035. Both WM and INFORUM project slight decreases in minemouth coal prices, to \$31.14 per ton and \$30.91 per ton in 2025, respectively.

## Comparison with Other Projections

**Table 15. Comparison of coal projections, 2015, 2025, and 2035 (million short tons, except where noted)**

Projection	2008	AEO2010 Reference case	Other projections				
			IHSGI	DB	IEA	WM	INFORUM
<b>2015</b>							
<b>Production</b>	<b>1,172</b>	<b>1,155</b>	<b>1,141</b>	–	–	<b>1,149<sup>a</sup></b>	<b>1,254</b>
<b>Consumption by sector</b>							
Electric power	1,042	1,044	1,042	–	–	–	–
Coke plants	22	20	21	–	–	–	–
Coal-to-liquids	0	21	–	–	–	–	–
Other industrial/buildings	58	56	57	–	–	–	–
<b>Total</b>	<b>1,122</b>	<b>1,141</b>	<b>1,120</b>	<b>23.0<sup>b</sup></b>	<b>21.8<sup>b</sup></b>	–	–
<b>Net coal exports</b>	<b>49</b>	<b>30</b>	<b>19</b>	–	–	<b>3<sup>a</sup></b>	<b>65</b>
Exports	82	60	57	–	–	19 <sup>a</sup>	102
Imports	32	30	38	–	–	16 <sup>a</sup>	37
<b>Minemouth price</b>							
(2008 dollars per short ton)	31.26	30.38	27.26 <sup>c</sup>	–	–	27.42 <sup>d</sup>	31.15
(2008 dollars per million Btu)	1.55	1.52	1.32	–	–	1.37 <sup>d</sup>	–
<b>Average delivered price to electricity generators</b>							
(2008 dollars per short ton)	40.71	39.46	41.14 <sup>c</sup>	–	–	41.64 <sup>d</sup>	40.57
(2008 dollars per million Btu)	2.05	2.01	2.00	–	–	2.09 <sup>d</sup>	–
<b>2025</b>							
<b>Production</b>	<b>1,172</b>	<b>1,234</b>	<b>1,109</b>	–	–	<b>1,180<sup>a</sup></b>	<b>1,465</b>
<b>Consumption by sector</b>							
Electric power	1,042	1,116	1,021	–	–	–	–
Coke plants	22	19	20	–	–	–	–
Coal-to-liquids	0	44	–	–	–	–	–
Other industrial/buildings	58	56	54	–	–	–	–
<b>Total</b>	<b>1,122</b>	<b>1,235</b>	<b>1,095</b>	<b>21.9<sup>a</sup></b>	<b>22.7<sup>b</sup></b>	–	–
<b>Net coal exports</b>	<b>49</b>	<b>14</b>	<b>14</b>	–	–	<b>0<sup>a</sup></b>	<b>118</b>
Exports	82	48	49	–	–	26 <sup>a</sup>	161
Imports	32	34	35	–	–	26 <sup>a</sup>	43
<b>Minemouth price</b>							
(2008 dollars per short ton)	31.26	28.19	26.08 <sup>c</sup>	–	–	31.14 <sup>d</sup>	30.91
(2008 dollars per million Btu)	1.55	1.44	1.27	–	–	1.57 <sup>d</sup>	–
<b>Average delivered price to electricity generators</b>							
(2008 dollars per short ton)	40.71	38.49	39.33 <sup>c</sup>	–	–	46.01 <sup>d</sup>	40.25
(2008 dollars per million Btu)	2.05	1.99	1.91	–	–	2.32 <sup>d</sup>	–

Btu = British thermal unit. – = not reported. See notes and sources at end of table.

## Comparison with Other Projections

**Table 15. Comparison of coal projections, 2015, 2025, and 2035 (continued)**  
(million short tons, except where noted)

Projection	2008	AEO2010 Reference case	Other projections				
			IHSGI	DB	IEA	WM	INFORUM
			<b>2035</b>				
<b>Production</b>	<b>1,172</b>	<b>1,285</b>	<b>1,098</b>	-	-	-	-
<b>Consumption by sector</b>							
Electric power	1,042	1,183	1,018	-	-	-	-
Coke plants	22	14	19	-	-	-	-
Coal-to-liquids	0	68					
Other industrial/buildings	58	54	49	-	-	-	-
<b>Total</b>	<b>1,122</b>	<b>1,319</b>	<b>1,086</b>	<b>20.8<sup>b</sup></b>	-	-	-
<b>Net coal exports</b>	<b>49</b>	<b>-20</b>	<b>12</b>	-	-	-	-
Exports	82	33	45	-	-	-	-
Imports	32	53	33	-	-	-	-
<b>Minemouth price</b>							
(2008 dollars per short ton)	31.26	28.10	25.81 <sup>c</sup>	-	-	-	-
(2008 dollars per million Btu)	1.55	1.44	1.26	-	-	-	-
<b>Average delivered price to electricity generators</b>							
(2008 dollars per short ton)	40.71	40.74	39.02 <sup>c</sup>	-	-	-	-
(2008 dollars per million Btu)	2.05	2.09	1.90	-	-	-	-

Btu = British thermal unit. - = not reported.

<sup>a</sup>Excludes coking coal.

<sup>b</sup>Reported in quadrillion Btu.

<sup>c</sup>Imputed, using heat conversion factor implied by U.S. steam coal consumption figures for the electricity sector.

<sup>d</sup>Converted to 2008 dollars, using the AEO2010 GDP inflator.

Sources: **2008 and AEO2010:** AEO2010 National Energy Modeling System, run AEO2010R.D111809A. **IHSGI:** IHS Global Insight, Inc., 2009 U.S. Energy Outlook (September 2009). **DB:** Deutsche Bank AG, e-mail from Adam Sieminski (December 31, 2009). **IEA:** International Energy Agency, *World Energy Outlook 2009* (Paris, France, November 2009). **WM:** Wood Mackenzie Company, *Fall 2009 Long Term Outlook Base Case*. **INFORUM:** INFORUM Base, e-mail from Douglas Meade (January 15, 2010).