

List of acronyms

AB 32	California Assembly Bill 32, the Global Warming Solutions Act of 2006	EE	energy efficiency
ACEEE	American Council for an Energy-Efficient Economy	EEPS	energy efficiency portfolio standard
ACP	alternative compliance payment	EERS	energy efficiency resource standard
AEO	Annual Energy Outlook	EFD	Electricity Fuel Dispatch
AEO2016	Annual Energy Outlook 2016	EG	Steam Electric Power Generating Effluent Guidelines and Standards
ACU	atmospheric cracking unit	EGUs	electric generating units
API	American Petroleum Institute	EIA	U.S. Energy Information Administration
ARRA	American Recovery and Reinvestment Act	EIEA2008	Energy Improvement and Extension Act of 2008
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers	EISA	Energy Independence and Security Act of 2007
ATPZEV	advanced technology partial zero-emission vehicle	EMM	Electricity Market Module
b	barrel	EM&V	energy measurement and verification
b/d	barrels per day	EPA	U.S. Environmental Protection Agency
BAT	best available technology	EPACT2005	Energy Policy Act of 2005
Bcf	billion cubic feet	ERCOT	Electric Reliability Council of Texas
Bcf/d	billion cubic feet per day	EUR	estimated ultimate recovery
BF	blast furnace	FCC	fluid catalytic cracking
BOF	basic oxygen furnace	FHWA	Federal Highway Administration
BSER	best system of emission reduction	GDP	gross domestic product
BTL	biomass-to-liquids	GEM	Greenhouse Gas Emissions Model
Btu	British thermal unit	GHG	greenhouse gas
Btu/scf	Btu per standard cubic foot	GTL	gas-to-liquids
CAA	Clean Air Act	GVWR	gross vehicle weight rating
CAFE	Corporate Average Fuel Economy	GW	gigawatt
CAIR	Clean Air Interstate Rule	HB2001	West Virginia House Bill 2001
CARB	California Air Resource Board	HB40	Vermont House Bill 40
CBTL	coal-and-biomass-to-liquids	HB623	Hawaii House Bill 623
CCR	Coal Combustion Residual rule	HD	heavy-duty
CCS	carbon capture and storage	HDV	heavy-duty vehicle
CHP	combined heat and power	HGL	hydrocarbon gas liquids
CMM	Coal Market Module	HVAC	heating, ventilation, and air conditioning
CNG	compressed natural gas	IDM	Industrial Demand Module
CO2	carbon dioxide	IEM	International Energy Module
CPP	Clean Power Plan	IMO	International Maritime Organization
CSAPR	Cross State Air Pollution Rule	IOU	investor-owned utility
CT	combustion turbine	ITC	investment tax credit
CTL	coal-to-liquids	kWh	kilowatthour
CWA	Clean Water Act	LACE	levelized avoided cost of electricity
DG	distributed generation	LADWP	Los Angeles Department of Water and Power
DOE	U.S. Department of Energy	LCFS	Low Carbon Fuel Standard
DOI	U.S. Department of Interior	LCOE	levelized cost of electricity
DOT	U.S. Department of Transportation	LDV	light-duty vehicle
DRI	direct reduced iron	LFG	landfill gas
DSI	dry sorbent injection	LFMM	Liquid Fuels Market Module
DSIRE	Database of State Incentives for Renewables & Efficiency	LIPA	Long Island Power Authority
EAER	equivalent all-electric range	LNG	liquefied natural gas
EAF	electric arc furnace	LPG	liquefied petroleum gas
ECAs	U.S. Emission Control Areas	MAM	Macroeconomic Activity Module
ECP	Electricity Capacity Planning	MARPOL	International Convention for the Prevention of Pollution from Ships

MATS	Mercury Air Toxics Standard	POU	publicly owned utility
MDV	medium-duty vehicle	PRB	Wyoming Powder River Basin
MECS	Manufacturing Energy Consumption Survey	PTC	production tax credit
MGO	marine gas oil	PUC	public utility commission
MMST	million metric short tons	PV	solar photovoltaic
MMT	million metric tons	PZEV	partial zero-emission vehicle
MOU	memorandum of understanding	RECs	Renewable Energy Certificates
mpg	miles per gallon	RFM	Renewable Fuels Module
MSW	municipal solid waste	RFS	Renewable Fuels Standard
MT	metric ton	RGGI	Regional Greenhouse Gas Initiative
MW	megawatt	RPS	Renewable Portfolio Standards
MWh	megawatthour	SB91	Kansas Senate Bill 91
MY	model year	SB310	Ohio Senate Bill 310
NAICS	North American Industry Classification System	SB350	California Senate Bill 350
NEEP	Northeast Energy Efficiency Partnerships	SEU	Sustainable Energy Utility
NEMS	National Energy Modeling System	SO _x	sulfur oxide
NGPL	natural gas plant liquids	SO ₂	sulfur dioxide
NGTDM	Natural Gas Transmission and Distribution Module	SPR	Strategic Petroleum Reserve
NHTSA	U.S. National Highway Traffic Safety Administration	SPR	Stream Protection Rule
NO _x	nitrogen oxide	STEO	Short-Term Energy Outlook
NPDES	National Pollutant Discharge Elimination System	Tcf	trillion cubic feet
NSPS	new source performance standards	TZEV	transitional zero-emission vehicle
NYPA	New York Power Authority	VIUS	Vehicle Inventory and Use Survey
OECD	Organization for Economic Cooperation and Development	VMT	vehicle miles traveled
OPEC	Organization of the Petroleum Exporting Countries	WTI	West Texas Intermediate
PADD	Petroleum Administration for Defense District	ZEV	zero-emission vehicle
PM _{2.5}	fine particulate matter		

Appendix A
Reference case

Table A1. Total energy supply, disposition, and price summary
(quadrillion Btu per year, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Production								
Crude oil and lease condensate	18.4	19.7	19.6	19.7	21.0	22.3	23.5	0.7%
Natural gas plant liquids	4.1	4.4	6.1	6.4	6.5	6.6	6.7	1.6%
Dry natural gas	26.5	28.0	31.4	35.9	38.9	41.2	43.4	1.8%
Coal ¹	20.6	17.2	17.5	15.4	13.3	13.4	13.1	-1.1%
Nuclear / uranium ²	8.3	8.3	8.1	8.2	8.2	8.2	8.2	0.0%
Conventional hydroelectric power	2.5	2.3	2.8	2.8	2.8	2.8	2.8	0.8%
Biomass ³	4.4	4.1	4.2	4.3	4.4	4.4	4.6	0.4%
Other renewable energy ⁴	2.5	2.6	4.6	6.1	6.6	7.8	8.8	5.0%
Other ⁵	1.0	0.5	0.9	1.0	0.9	0.9	1.0	2.8%
Total	88.4	87.3	95.4	99.8	102.7	107.7	112.2	1.0%
Imports								
Crude oil	16.3	16.1	16.8	16.8	16.0	15.8	15.9	-0.1%
Petroleum and other liquids ⁶	3.9	3.9	4.5	4.5	4.3	4.2	4.3	0.4%
Natural gas ⁷	2.8	2.8	2.1	1.8	1.6	1.4	1.4	-2.6%
Other imports ⁸	0.4	0.4	0.2	0.2	0.2	0.2	0.2	-3.9%
Total	23.3	23.2	23.6	23.2	22.0	21.5	21.8	-0.3%
Exports								
Petroleum and other liquids ⁹	8.2	9.0	11.6	12.5	13.5	14.4	15.2	2.1%
Natural gas ¹⁰	1.5	1.8	5.0	7.1	7.6	8.6	9.0	6.7%
Coal	2.5	2.0	1.9	1.8	1.9	2.2	2.3	0.7%
Total	12.2	12.8	18.5	21.4	23.0	25.2	26.6	3.0%
Discrepancy¹¹	1.4	1.0	0.0	0.1	0.1	0.2	0.3	--
Consumption								
Petroleum and other liquids ¹²	36.0	36.5	37.8	37.3	36.6	36.8	37.5	0.1%
Natural gas	27.5	28.3	28.3	30.2	32.5	33.5	35.4	0.9%
Coal ¹³	17.9	15.5	15.6	13.5	11.3	11.2	10.7	-1.4%
Nuclear / uranium ²	8.3	8.3	8.1	8.2	8.2	8.2	8.2	0.0%
Conventional hydroelectric power	2.5	2.3	2.8	2.8	2.8	2.8	2.8	0.8%
Biomass ¹⁴	3.0	2.8	2.8	2.9	3.0	3.0	3.1	0.5%
Other renewable energy ⁴	2.5	2.6	4.6	6.1	6.6	7.8	8.8	5.0%
Other ¹⁵	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1%
Total	98.1	96.7	100.5	101.6	101.5	103.9	107.1	0.4%
Prices (2015 dollars per unit)								
Crude oil spot prices (dollars per barrel)								
Brent	100	52	77	92	104	120	136	3.9%
West Texas Intermediate	94	49	71	85	97	112	129	4.0%
Natural gas at Henry Hub (dollars per million Btu)								
Coal (dollars per ton)								
at the minemouth ¹⁶	35.2	33.8	33.6	34.0	33.8	37.6	38.7	0.5%
Coal (dollars per million Btu)								
at the minemouth ¹⁶	1.73	1.69	1.68	1.71	1.71	1.86	1.91	0.5%
Average end-use ¹⁷	2.52	2.37	2.43	2.49	2.55	2.61	2.68	0.5%
Average electricity (cents per kilowatthour)	10.5	10.3	10.5	10.7	10.9	10.6	10.5	0.1%

Table A1. Total energy supply, disposition, and price summary (continued)
(quadrillion Btu per year, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Prices (nominal dollars per unit)								
Crude oil spot prices (dollars per barrel)								
Brent	99	52	85	112	141	181	229	6.1%
West Texas Intermediate	93	49	79	105	131	170	217	6.2%
Natural gas at Henry Hub (dollars per million Btu)	4.39	2.62	4.90	6.27	6.84	7.42	8.17	4.7%
Coal (dollars per ton)								
at the minemouth ¹⁶	34.9	33.8	37.1	41.6	45.8	56.8	65.1	2.7%
Coal (dollars per million Btu)								
at the minemouth ¹⁶	1.71	1.69	1.86	2.09	2.31	2.81	3.21	2.6%
Average end-use ¹⁷	2.49	2.37	2.69	3.05	3.45	3.94	4.50	2.6%
Average electricity (cents per kilowatthour)	10.4	10.3	11.6	13.1	14.7	16.1	17.6	2.2%

¹Includes waste coal.

²These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

³Includes grid-connected electricity from wood and wood waste; biomass, such as corn, used for liquid fuels production; and non-electric energy demand from wood. Refer to Table A17 for details.

⁴Includes grid-connected electricity from landfill gas; biogenic municipal waste; wind; photovoltaic and solar thermal sources; and non-electric energy from renewable sources, such as active and passive solar systems. Excludes electricity imports using renewable sources and nonmarketed renewable energy. See Table A17 for selected nonmarketed residential and commercial renewable energy data.

⁵Includes non-biogenic municipal waste, liquid hydrogen, methanol, and some domestic inputs to refineries.

⁶Includes imports of finished petroleum products, unfinished oils, alcohols, ethers, blending components, and renewable fuels such as ethanol.

⁷Includes imports of liquefied natural gas that are later re-exported.

⁸Includes coal, coal coke (net), and electricity (net). Excludes imports of fuel used in nuclear power plants.

⁹Includes crude oil, petroleum products, ethanol, and biodiesel.

¹⁰Includes re-exported liquefied natural gas.

¹¹Balancing item. Includes unaccounted for supply, losses, gains, and net storage withdrawals.

¹²Estimated consumption. Includes petroleum-derived fuels and non-petroleum derived fuels, such as ethanol and biodiesel, and coal-based synthetic liquids. Petroleum coke, which is a solid, is included. Also included are hydrocarbon gas liquids and crude oil consumed as a fuel. Refer to Table A17 for detailed renewable liquid fuels consumption.

¹³Excludes coal converted to coal-based synthetic liquids and natural gas.

¹⁴Includes grid-connected electricity from wood and wood waste, non-electric energy from wood, and biofuels heat and coproducts used in the production of liquid fuels, but excludes the energy content of the liquid fuels.

¹⁵Includes non-biogenic municipal waste, liquid hydrogen, and net electricity imports.

¹⁶Includes reported prices for both open market and captive mines. Prices weighted by production, which differs from average minemouth prices published in EIA data reports where it is weighted by reported sales.

¹⁷Prices weighted by consumption; weighted average excludes export free-alongside-ship (f.a.s.) prices.

Btu = British thermal unit.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 natural gas supply values: EIA, *Natural Gas Monthly*, July 2015. 2014 coal minemouth and delivered coal prices: EIA, *Annual Coal Report 2013*. 2014 petroleum supply values: EIA, *Petroleum Supply Annual 2014*. 2014 crude oil spot prices and natural gas spot price at Henry Hub: Thomson Reuters. Other 2014 coal values: *Quarterly Coal Report, October-December 2014*. Other 2014: EIA, *Monthly Energy Review*, February 2016. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A2. Energy consumption by sector and source
(quadrillion Btu per year, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Energy consumption								
Residential								
Propane	0.50	0.43	0.42	0.40	0.38	0.36	0.34	-0.9%
Kerosene	0.01	0.01	0.01	0.01	0.01	0.00	0.00	-2.6%
Distillate fuel oil	0.55	0.50	0.43	0.38	0.34	0.30	0.27	-2.4%
Petroleum and other liquids subtotal	1.05	0.93	0.86	0.78	0.72	0.66	0.61	-1.7%
Natural gas	5.25	4.77	4.87	4.82	4.80	4.77	4.73	0.0%
Renewable energy ¹	0.59	0.44	0.42	0.41	0.39	0.38	0.37	-0.7%
Electricity	4.80	4.78	4.76	4.75	4.83	4.97	5.20	0.3%
Delivered energy	11.70	10.92	10.90	10.77	10.74	10.78	10.91	0.0%
Electricity related losses	9.72	9.44	9.37	9.03	8.77	8.93	9.15	-0.1%
Total	21.42	20.37	20.27	19.79	19.50	19.71	20.05	-0.1%
Commercial								
Propane	0.15	0.17	0.18	0.19	0.19	0.20	0.20	0.7%
Motor gasoline ²	0.04	0.04	0.06	0.06	0.06	0.07	0.07	2.1%
Kerosene	0.00	0.00	0.00	0.00	0.01	0.01	0.01	5.0%
Distillate fuel oil	0.36	0.37	0.36	0.34	0.32	0.30	0.29	-1.0%
Residual fuel oil	0.02	0.07	0.11	0.10	0.10	0.10	0.10	1.2%
Petroleum and other liquids subtotal	0.57	0.66	0.70	0.69	0.68	0.67	0.67	0.1%
Natural gas	3.58	3.32	3.45	3.46	3.53	3.66	3.81	0.5%
Coal	0.05	0.06	0.05	0.05	0.05	0.05	0.05	-0.4%
Renewable energy ³	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.0%
Electricity	4.61	4.64	4.69	4.86	5.09	5.33	5.62	0.8%
Delivered energy	8.95	8.81	9.03	9.20	9.49	9.86	10.28	0.6%
Electricity related losses	9.34	9.16	9.23	9.23	9.23	9.57	9.89	0.3%
Total	18.29	17.97	18.26	18.43	18.72	19.43	20.17	0.5%
Industrial⁴								
Liquefied petroleum gases and other ⁵	2.44	2.38	3.10	3.50	3.66	3.92	4.22	2.3%
Motor gasoline ²	0.27	0.27	0.28	0.27	0.27	0.27	0.27	0.0%
Distillate fuel oil	1.36	1.34	1.44	1.45	1.44	1.45	1.47	0.4%
Residual fuel oil	0.03	0.04	0.04	0.06	0.06	0.05	0.05	1.6%
Petrochemical feedstocks	0.70	0.66	0.96	1.21	1.31	1.47	1.66	3.8%
Other petroleum ⁶	3.19	3.38	3.59	3.71	3.82	3.95	4.15	0.8%
Petroleum and other liquids subtotal	7.99	8.07	9.40	10.19	10.55	11.13	11.82	1.5%
Natural gas	7.84	7.75	8.55	8.93	9.13	9.49	9.89	1.0%
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Lease and plant fuel ⁷	1.55	1.63	1.76	1.94	2.06	2.19	2.31	1.4%
Natural gas liquefaction for export ⁸	0.00	0.00	0.26	0.48	0.53	0.64	0.69	--
Natural gas subtotal	9.40	9.38	10.57	11.34	11.72	12.32	12.89	1.3%
Metallurgical coal	0.58	0.54	0.41	0.45	0.47	0.43	0.40	-1.2%
Other industrial coal	0.87	0.82	0.82	0.86	0.88	0.89	0.93	0.5%
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Net coal coke imports	-0.02	-0.02	-0.01	0.00	0.00	0.01	0.01	--
Coal subtotal	1.43	1.34	1.23	1.31	1.35	1.33	1.34	0.0%
Biofuels heat and coproducts	0.75	0.78	0.83	0.80	0.81	0.81	0.84	0.3%
Renewable energy ⁹	1.52	1.48	1.48	1.59	1.67	1.70	1.79	0.8%
Electricity	3.40	3.27	3.61	3.91	3.98	4.08	4.26	1.1%
Delivered energy	24.49	24.33	27.11	29.14	30.07	31.38	32.94	1.2%
Electricity related losses	6.89	6.46	7.11	7.42	7.22	7.34	7.50	0.6%
Total	31.38	30.79	34.22	36.56	37.29	38.72	40.44	1.1%

Table A2. Energy consumption by sector and source (continued)
(quadrillion Btu per year, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Transportation								
Propane.....	0.01	0.01	0.01	0.01	0.01	0.01	0.02	3.3%
Motor gasoline ²	16.78	17.01	16.79	15.05	13.62	12.84	12.55	-1.2%
of which: E85 ¹⁰	0.03	0.05	0.04	0.12	0.22	0.27	0.28	7.3%
Jet fuel ¹¹	2.82	2.84	2.99	3.14	3.32	3.46	3.56	0.9%
Distillate fuel oil ¹²	6.40	6.67	6.99	7.28	7.49	7.77	8.01	0.7%
Residual fuel oil.....	0.44	0.45	0.37	0.40	0.42	0.44	0.45	0.1%
Other petroleum ¹³	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.1%
Petroleum and other liquids subtotal.....	26.61	27.14	27.32	26.04	25.01	24.68	24.75	-0.4%
Pipeline fuel natural gas.....	0.87	0.89	0.83	0.89	0.94	1.00	1.07	0.7%
Compressed / liquefied natural gas.....	0.06	0.07	0.08	0.10	0.17	0.31	0.59	9.2%
Liquid hydrogen.....	0.00	0.00	0.01	0.03	0.04	0.05	0.06	22.9%
Electricity.....	0.03	0.03	0.05	0.08	0.11	0.14	0.15	6.7%
Delivered energy	27.56	28.13	28.29	27.13	26.28	26.18	26.63	-0.2%
Electricity related losses.....	0.05	0.06	0.09	0.15	0.20	0.24	0.27	6.2%
Total	27.61	28.19	28.38	27.28	26.48	26.42	26.90	-0.2%
Unspecified sector¹⁴	-0.57	-0.58	-0.58	-0.52	-0.46	-0.43	-0.42	-1.3%
Delivered energy consumption for all sectors								
Liquefied petroleum gases and other ⁵	3.09	2.99	3.71	4.09	4.24	4.49	4.79	1.9%
Motor gasoline ²	16.51	16.96	16.55	14.87	13.49	12.74	12.47	-1.2%
of which: E85 ¹⁰	0.03	0.05	0.04	0.12	0.22	0.27	0.28	7.3%
Jet fuel ¹¹	3.04	3.18	3.22	3.38	3.58	3.72	3.83	0.7%
Kerosene.....	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.3%
Distillate fuel oil.....	8.45	8.33	8.98	9.19	9.33	9.56	9.77	0.6%
Residual fuel oil.....	0.50	0.56	0.52	0.56	0.57	0.59	0.60	0.3%
Petrochemical feedstocks.....	0.70	0.66	0.96	1.21	1.31	1.47	1.66	3.8%
Other petroleum ¹⁵	3.35	3.54	3.75	3.87	3.98	4.12	4.31	0.8%
Petroleum and other liquids subtotal.....	35.65	36.23	37.70	37.18	36.51	36.71	37.44	0.1%
Natural gas.....	16.73	15.90	16.95	17.31	17.63	18.23	19.02	0.7%
Natural-gas-to-liquids heat and power.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Lease and plant fuel ⁷	1.55	1.63	1.76	1.94	2.06	2.19	2.31	1.4%
Natural gas liquefaction for export ⁸	0.00	0.00	0.26	0.48	0.53	0.64	0.69	--
Pipeline fuel natural gas.....	0.87	0.89	0.83	0.89	0.94	1.00	1.07	0.7%
Natural gas subtotal.....	19.15	18.43	19.80	20.61	21.16	22.06	23.09	0.9%
Metallurgical coal.....	0.58	0.54	0.41	0.45	0.47	0.43	0.40	-1.2%
Other coal.....	0.92	0.88	0.88	0.92	0.93	0.95	0.98	0.5%
Coal-to-liquids heat and power.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Net coal coke imports.....	-0.02	-0.02	-0.01	0.00	0.00	0.01	0.01	--
Coal subtotal.....	1.48	1.40	1.28	1.36	1.40	1.39	1.39	0.0%
Biofuels heat and coproducts.....	0.75	0.78	0.83	0.80	0.81	0.81	0.84	0.3%
Renewable energy ¹⁶	2.24	2.06	2.03	2.13	2.19	2.22	2.29	0.4%
Liquid hydrogen.....	0.00	0.00	0.01	0.03	0.04	0.05	0.06	22.9%
Electricity.....	12.84	12.72	13.11	13.60	14.01	14.52	15.23	0.7%
Delivered energy	72.12	71.62	74.75	75.73	76.12	77.77	80.34	0.5%
Electricity related losses.....	26.01	25.12	25.80	25.83	25.41	26.09	26.81	0.3%
Total	98.13	96.74	100.55	101.56	101.54	103.85	107.15	0.4%
Electric power¹⁷								
Distillate fuel oil.....	0.09	0.09	0.09	0.08	0.06	0.06	0.05	-2.0%
Residual fuel oil.....	0.22	0.17	0.06	0.05	0.04	0.04	0.03	-6.6%
Petroleum and other liquids subtotal.....	0.31	0.26	0.15	0.13	0.11	0.10	0.09	-4.4%
Natural gas.....	8.38	9.89	8.50	9.60	11.34	11.46	12.31	0.9%
Steam coal.....	16.42	14.08	14.34	12.12	9.92	9.82	9.36	-1.6%
Nuclear / uranium ¹⁸	8.33	8.34	8.12	8.25	8.25	8.25	8.25	0.0%
Renewable energy ¹⁹	5.01	4.86	7.37	8.91	9.41	10.60	11.67	3.6%
Non-biogenic municipal waste.....	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.0%
Electricity imports.....	0.18	0.19	0.19	0.20	0.17	0.16	0.15	-1.1%
Total	38.86	37.85	38.90	39.43	39.42	40.61	42.04	0.4%

Table A2. Energy consumption by sector and source (continued)
(quadrillion Btu per year, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Total energy consumption								
Liquefied petroleum gases and other ⁵	3.09	2.99	3.71	4.09	4.24	4.49	4.79	1.9%
Motor gasoline ²	16.51	16.96	16.55	14.87	13.49	12.74	12.47	-1.2%
of which: E85 ¹⁰	0.03	0.05	0.04	0.12	0.22	0.27	0.28	7.3%
Jet fuel ¹¹	3.04	3.18	3.22	3.38	3.58	3.72	3.83	0.7%
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.3%
Distillate fuel oil	8.54	8.42	9.07	9.27	9.40	9.62	9.82	0.6%
Residual fuel oil	0.72	0.73	0.58	0.61	0.62	0.63	0.64	-0.5%
Petrochemical feedstocks	0.70	0.66	0.96	1.21	1.31	1.47	1.66	3.8%
Other petroleum ¹⁵	3.35	3.54	3.75	3.87	3.98	4.12	4.31	0.8%
Petroleum and other liquids subtotal	35.96	36.49	37.85	37.31	36.62	36.81	37.52	0.1%
Natural gas	25.11	25.79	25.45	26.91	28.97	29.69	31.33	0.8%
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Lease and plant fuel ⁷	1.55	1.63	1.76	1.94	2.06	2.19	2.31	1.4%
Natural gas liquefaction for export ⁸	0.00	0.00	0.26	0.48	0.53	0.64	0.69	--
Pipeline fuel natural gas	0.87	0.89	0.83	0.89	0.94	1.00	1.07	0.7%
Natural gas subtotal	27.53	28.31	28.30	30.22	32.51	33.52	35.39	0.9%
Metallurgical coal	0.58	0.54	0.41	0.45	0.47	0.43	0.40	-1.2%
Other coal	17.34	14.96	15.22	13.04	10.86	10.77	10.34	-1.5%
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Net coal coke imports	-0.02	-0.02	-0.01	0.00	0.00	0.01	0.01	--
Coal subtotal	17.90	15.48	15.62	13.49	11.32	11.21	10.75	-1.4%
Nuclear / uranium ¹⁸	8.33	8.34	8.12	8.25	8.25	8.25	8.25	0.0%
Biofuels heat and coproducts	0.75	0.78	0.83	0.80	0.81	0.81	0.84	0.3%
Renewable energy ²⁰	7.26	6.92	9.40	11.04	11.60	12.82	13.96	2.8%
Liquid hydrogen	0.00	0.00	0.01	0.03	0.04	0.05	0.06	22.9%
Non-biogenic municipal waste	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.0%
Electricity imports	0.18	0.19	0.19	0.20	0.17	0.16	0.15	-1.1%
Total	98.13	96.74	100.55	101.56	101.54	103.85	107.15	0.4%
Energy use and related statistics								
Delivered energy use	72.12	71.62	74.75	75.73	76.12	77.77	80.34	0.5%
Total energy use	98.13	96.74	100.55	101.56	101.54	103.85	107.15	0.4%
Ethanol consumed in motor gasoline and E85	1.14	1.18	1.19	1.13	1.12	1.14	1.24	0.2%
Population (millions)	319	322	335	348	360	371	381	0.7%
Gross domestic product (billion 2009 dollars)	15,962	16,349	18,555	20,765	23,113	25,598	28,397	2.2%
Carbon dioxide emissions (million metric tons)	5,406	5,273	5,289	5,115	4,961	4,980	5,044	-0.2%

¹Includes wood used for residential heating. See Table A4 and/or Table A17 for estimates of nonmarketed renewable energy consumption for geothermal heat pumps, solar thermal water heating, and electricity generation from wind and solar photovoltaic sources.

²Includes ethanol and ethers blended into gasoline.

³Excludes ethanol. Includes commercial sector consumption of wood and wood waste, landfill gas, municipal waste, and other biomass for combined heat and power. See Table A5 and/or Table A17 for estimates of nonmarketed renewable energy consumption for solar thermal water heating and electricity generation from wind and solar photovoltaic sources.

⁴Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

⁵Includes ethane, natural gasoline, and refinery olefins.

⁶Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

⁷Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.

⁸Fuel used in facilities that liquefy natural gas for export.

⁹Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources. Excludes ethanol in motor gasoline.

¹⁰E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

¹¹Includes only kerosene type.

¹²Diesel fuel for on- and off- road use.

¹³Includes aviation gasoline and lubricants.

¹⁴Represents consumption unattributed to the sectors above.

¹⁵Includes aviation gasoline, petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

¹⁶Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes ethanol and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

¹⁷Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

¹⁸These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

¹⁹Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes net electricity imports.

²⁰Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes ethanol, net electricity imports, and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

Btu = British thermal unit.

-- = Not applicable.

Note: Includes estimated consumption for petroleum and other liquids. Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 consumption, carbon dioxide emissions, and emission factors based on: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2014 population and gross domestic product: IHS Economics, Industry and Employment models, November 2015. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A3. Energy prices by sector and source
(2015 dollars per million Btu, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Residential								
Propane.....	23.3	16.9	20.2	21.4	22.4	24.0	25.6	1.7%
Distillate fuel oil.....	26.9	19.3	22.4	25.5	27.8	30.8	33.8	2.3%
Natural gas.....	10.7	10.1	10.7	11.6	12.0	12.1	12.3	0.8%
Electricity.....	37.1	36.3	37.7	38.8	39.4	38.7	38.1	0.2%
Commercial								
Propane.....	20.6	15.1	17.9	18.9	19.8	21.2	22.5	1.6%
Distillate fuel oil.....	26.4	17.0	19.7	22.2	24.4	27.4	30.5	2.4%
Residual fuel oil.....	16.7	6.9	11.0	13.5	15.3	17.6	19.9	4.3%
Natural gas.....	9.0	7.7	9.3	10.1	10.4	10.3	10.4	1.2%
Electricity.....	31.8	30.6	31.5	32.0	32.3	31.4	30.7	0.0%
Industrial¹								
Propane.....	18.8	12.2	15.6	16.8	17.8	19.5	21.1	2.2%
Distillate fuel oil.....	27.1	17.0	19.7	22.2	24.4	27.4	30.5	2.4%
Residual fuel oil.....	15.0	6.8	11.3	14.2	15.9	18.2	20.6	4.6%
Natural gas ²	5.4	3.7	5.4	6.0	6.0	5.8	5.7	1.7%
Metallurgical coal.....	5.3	5.4	6.0	6.5	7.0	7.2	7.3	1.2%
Other industrial coal.....	3.2	3.4	3.4	3.4	3.4	3.5	3.6	0.2%
Coal to liquids.....	--	--	--	--	--	--	--	--
Electricity.....	21.0	20.3	20.9	21.5	22.1	21.5	21.2	0.2%
Transportation								
Propane.....	24.4	18.0	21.2	22.4	23.4	25.0	26.6	1.6%
E85 ³	33.3	23.3	32.0	31.2	30.8	32.3	35.0	1.6%
Motor gasoline ⁴	28.4	20.9	22.7	24.7	26.5	28.9	31.8	1.7%
Jet fuel ⁵	20.8	12.0	16.2	19.0	21.3	24.5	27.7	3.4%
Diesel fuel (distillate fuel oil) ⁶	27.8	19.8	23.1	25.8	28.0	31.0	34.1	2.2%
Residual fuel oil.....	14.6	8.1	11.7	13.4	15.0	17.0	19.2	3.5%
Natural gas ⁷	18.4	16.6	16.6	16.4	15.5	15.4	15.9	-0.2%
Electricity.....	32.2	29.5	33.0	36.0	37.4	36.4	35.5	0.7%
Electric power⁸								
Distillate fuel oil.....	23.8	15.0	18.4	21.2	23.5	26.4	29.4	2.7%
Residual fuel oil.....	18.3	10.2	13.8	16.3	18.1	20.2	22.4	3.2%
Natural gas.....	5.1	3.3	4.7	5.4	5.6	5.4	5.4	2.0%
Steam coal.....	2.4	2.2	2.3	2.3	2.3	2.3	2.4	0.3%
Average price to all users⁹								
Propane.....	21.2	14.9	18.0	19.2	20.1	21.6	23.2	1.8%
E85 ³	33.3	23.3	32.0	31.2	30.8	32.3	35.0	1.6%
Motor gasoline ⁴	28.4	20.9	22.7	24.7	26.5	28.9	31.8	1.7%
Jet fuel ⁵	20.8	12.0	16.2	19.0	21.3	24.5	27.7	3.4%
Distillate fuel oil.....	27.5	19.1	22.3	25.1	27.3	30.3	33.3	2.2%
Residual fuel oil.....	15.8	8.4	11.7	13.8	15.4	17.4	19.6	3.4%
Natural gas.....	6.9	5.3	6.7	7.4	7.4	7.3	7.4	1.4%
Metallurgical coal.....	5.3	5.4	6.0	6.5	7.0	7.2	7.3	1.2%
Other coal.....	2.4	2.3	2.3	2.4	2.4	2.4	2.5	0.4%
Coal to liquids.....	--	--	--	--	--	--	--	--
Electricity.....	30.9	30.1	30.8	31.4	31.9	31.2	30.6	0.1%
Non-renewable energy expenditures by sector (billion 2015 dollars)								
Residential.....	261	239	250	259	266	268	274	0.6%
Commercial.....	193	178	193	205	216	221	230	1.0%
Industrial ¹	231	168	232	276	301	330	369	3.2%
Transportation.....	707	514	586	615	640	698	777	1.7%
Total non-renewable expenditures.....	1,391	1,099	1,260	1,355	1,423	1,517	1,650	1.6%
Transportation renewable expenditures.....	1	1	1	4	7	9	10	9.1%
Total expenditures.....	1,393	1,100	1,262	1,359	1,430	1,526	1,660	1.7%

Table A3. Energy prices by sector and source (continued)
(nominal dollars per million Btu, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Residential								
Propane	23.1	16.9	22.3	26.2	30.3	36.2	43.0	3.8%
Distillate fuel oil	26.7	19.3	24.7	31.2	37.6	46.5	56.9	4.4%
Natural gas	10.6	10.1	11.9	14.2	16.3	18.3	20.8	2.9%
Electricity	36.7	36.3	41.7	47.5	53.3	58.4	64.2	2.3%
Commercial								
Propane	20.4	15.1	19.8	23.2	26.8	31.9	37.9	3.8%
Distillate fuel oil	26.1	17.0	21.8	27.2	33.1	41.4	51.2	4.5%
Residual fuel oil	16.5	6.9	12.1	16.5	20.7	26.5	33.6	6.5%
Natural gas	8.9	7.7	10.3	12.3	14.1	15.6	17.5	3.4%
Electricity	31.5	30.6	34.8	39.2	43.7	47.4	51.7	2.1%
Industrial¹								
Propane	18.7	12.2	17.2	20.6	24.1	29.4	35.6	4.4%
Distillate fuel oil	26.8	17.0	21.8	27.2	33.1	41.4	51.3	4.5%
Residual fuel oil	14.8	6.8	12.4	17.4	21.6	27.5	34.7	6.8%
Natural gas ²	5.3	3.7	5.9	7.3	8.1	8.7	9.6	3.9%
Metallurgical coal	5.3	5.4	6.7	8.0	9.4	10.9	12.2	3.3%
Other industrial coal	3.2	3.4	3.7	4.2	4.6	5.2	6.0	2.4%
Coal to liquids	--	--	--	--	--	--	--	--
Electricity	20.8	20.3	23.1	26.3	29.9	32.5	35.7	2.3%
Transportation								
Propane	24.1	18.0	23.4	27.5	31.7	37.8	44.8	3.7%
E85 ³	32.9	23.3	35.4	38.2	41.7	48.8	58.8	3.8%
Motor gasoline ⁴	28.1	20.9	25.1	30.2	35.9	43.7	53.6	3.8%
Jet fuel ⁵	20.6	12.0	17.9	23.2	28.8	37.0	46.6	5.6%
Diesel fuel (distillate fuel oil) ⁶	27.5	19.8	25.5	31.6	37.9	46.7	57.3	4.3%
Residual fuel oil	14.5	8.1	12.9	16.5	20.3	25.7	32.3	5.7%
Natural gas ⁷	18.2	16.6	18.4	20.0	21.0	23.2	26.7	1.9%
Electricity	31.8	29.5	36.5	44.1	50.5	55.0	59.8	2.9%
Electric power⁸								
Distillate fuel oil	23.5	15.0	20.4	26.0	31.8	39.9	49.4	4.9%
Residual fuel oil	18.1	10.2	15.2	19.9	24.4	30.5	37.8	5.4%
Natural gas	5.0	3.3	5.2	6.6	7.5	8.1	9.0	4.2%
Steam coal	2.4	2.2	2.5	2.8	3.1	3.5	4.0	2.5%

Table A3. Energy prices by sector and source (continued)
(nominal dollars per million Btu, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Average price to all users⁹								
Propane	21.0	14.9	19.9	23.5	27.2	32.6	39.0	3.9%
E85 ³	32.9	23.3	35.4	38.2	41.7	48.8	58.8	3.8%
Motor gasoline ⁴	28.1	20.9	25.1	30.2	35.9	43.7	53.6	3.8%
Jet fuel ⁵	20.6	12.0	17.9	23.2	28.8	37.0	46.6	5.6%
Distillate fuel oil	27.2	19.1	24.7	30.7	36.9	45.7	56.1	4.4%
Residual fuel oil	15.7	8.4	13.0	16.8	20.8	26.2	32.9	5.6%
Natural gas	6.9	5.3	7.4	9.0	10.0	11.1	12.4	3.5%
Metallurgical coal	5.3	5.4	6.7	8.0	9.4	10.9	12.2	3.3%
Other coal	2.4	2.3	2.6	2.9	3.2	3.7	4.2	2.5%
Coal to liquids	--	--	--	--	--	--	--	--
Electricity	30.6	30.1	34.1	38.4	43.1	47.0	51.6	2.2%
Non-renewable energy expenditures by sector (billion nominal dollars)								
Residential	258	239	276	317	360	405	462	2.7%
Commercial	191	178	213	251	292	334	387	3.2%
Industrial ¹	229	168	256	338	407	498	620	5.4%
Transportation	699	514	647	753	866	1,054	1,307	3.8%
Total non-renewable expenditures	1,377	1,099	1,392	1,659	1,925	2,291	2,776	3.8%
Transportation renewable expenditures	1	1	1	5	9	13	17	11.4%
Total expenditures	1,378	1,100	1,394	1,663	1,934	2,304	2,793	3.8%

¹Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

²Excludes use for lease and plant fuel.

³E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

⁴Sales weighted-average price for all grades. Includes Federal, State, and local taxes.

⁵Kerosene-type jet fuel. Includes Federal and State taxes while excluding county and local taxes.

⁶Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes.

⁷Natural gas used as fuel in motor vehicles, trains, and ships. Includes estimated motor vehicle fuel taxes and estimated dispensing costs or charges.

⁸Includes electricity-only and combined heat and power plants that have a regulatory status.

⁹Weighted averages of end-use fuel prices are derived from the prices shown in each sector and the corresponding sectoral consumption.

Btu = British thermal unit.

-- = Not applicable.

Note: Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 prices for motor gasoline, distillate fuel oil, and jet fuel are based on prices in the U.S. Energy Information Administration (EIA), *Petroleum Marketing Monthly*, January 2015-December 2015. 2014 residential, commercial, and industrial natural gas delivered prices: EIA, *Natural Gas Monthly*, July 2015. 2015 transportation sector natural gas delivered prices derived from: U.S. Department of Energy, Clean Cities Alternative Fuel Price Report. 2014 electric power sector distillate and residual fuel oil prices: EIA, *Monthly Energy Review*, February 2016. 2014 electric power sector natural gas prices: EIA, *Electric Power Monthly*, April 2014 and April 2015, Table 4.2, and EIA, *State Energy Data Report 2013*. 2014 coal prices based on: EIA, *Quarterly Coal Report, October-December 2014* and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. 2014 electricity prices: EIA, *Monthly Energy Review*, February 2016. 2014 E85 prices derived from: U.S. Department of Energy, Clean Cities Alternative Fuel Price Report. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. **Projections:** EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A4. Residential sector key indicators and consumption
(quadrillion Btu per year, unless otherwise noted)

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Key indicators								
Households (millions)								
Single-family	80.1	80.6	84.4	88.5	92.2	95.5	99.0	0.8%
Multifamily.....	28.6	28.9	30.5	32.3	34.0	35.8	37.5	1.1%
Mobile homes	6.1	6.0	5.5	5.3	5.1	4.9	4.8	-0.9%
Total	114.8	115.4	120.4	126.0	131.3	136.3	141.4	0.8%
Average house square footage	1,686	1,694	1,733	1,768	1,799	1,828	1,857	0.4%
Energy intensity								
(million Btu per household)								
Delivered energy consumption	101.9	94.6	90.5	85.4	81.8	79.1	77.1	-0.8%
Total energy consumption	186.6	176.5	168.3	157.1	148.5	144.6	141.8	-0.9%
(thousand Btu per square foot)								
Delivered energy consumption	60.4	55.9	52.3	48.3	45.5	43.2	41.6	-1.2%
Total energy consumption	110.7	104.2	97.1	88.9	82.6	79.1	76.4	-1.2%
Delivered energy consumption by fuel								
Purchased electricity								
Space heating.....	0.43	0.33	0.36	0.35	0.34	0.34	0.33	0.0%
Space cooling	0.65	0.80	0.74	0.75	0.79	0.84	0.89	0.4%
Water heating	0.45	0.45	0.46	0.47	0.47	0.48	0.48	0.2%
Refrigeration	0.36	0.36	0.34	0.33	0.33	0.34	0.36	0.0%
Cooking	0.11	0.11	0.11	0.12	0.13	0.14	0.14	1.1%
Clothes dryers.....	0.20	0.21	0.21	0.22	0.23	0.24	0.26	0.9%
Freezers	0.08	0.08	0.07	0.07	0.07	0.06	0.06	-0.7%
Lighting	0.51	0.50	0.43	0.37	0.30	0.25	0.23	-3.0%
Clothes washers ¹	0.03	0.03	0.02	0.02	0.02	0.02	0.02	-2.0%
Dishwashers ¹	0.09	0.09	0.10	0.10	0.11	0.12	0.13	1.2%
Televisions and related equipment ²	0.30	0.29	0.26	0.25	0.26	0.29	0.32	0.4%
Computers and related equipment ³	0.11	0.11	0.09	0.08	0.07	0.06	0.05	-3.0%
Furnace fans and boiler circulation pumps	0.14	0.11	0.12	0.12	0.11	0.11	0.10	-0.5%
Other uses ⁴	1.34	1.32	1.43	1.50	1.60	1.70	1.82	1.3%
Delivered energy.....	4.80	4.78	4.76	4.75	4.83	4.97	5.20	0.3%
Natural gas								
Space heating.....	3.52	3.03	3.11	3.04	3.01	2.98	2.95	-0.1%
Space cooling	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-0.9%
Water heating	1.21	1.21	1.23	1.25	1.27	1.27	1.25	0.1%
Cooking	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.3%
Clothes dryers.....	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.7%
Other uses ⁵	0.25	0.25	0.24	0.24	0.23	0.23	0.22	-0.5%
Delivered energy.....	5.25	4.77	4.87	4.82	4.80	4.77	4.73	0.0%
Distillate fuel oil								
Space heating.....	0.49	0.45	0.40	0.35	0.31	0.28	0.25	-2.3%
Water heating	0.05	0.04	0.03	0.02	0.02	0.02	0.01	-4.7%
Other uses ⁶	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.6%
Delivered energy.....	0.55	0.50	0.43	0.38	0.34	0.30	0.27	-2.4%
Propane								
Space heating.....	0.37	0.29	0.30	0.27	0.26	0.24	0.22	-1.1%
Water heating	0.06	0.06	0.05	0.05	0.04	0.03	0.03	-2.7%
Cooking	0.03	0.03	0.03	0.03	0.02	0.02	0.02	-0.8%
Other uses ⁶	0.04	0.04	0.05	0.05	0.05	0.06	0.06	1.4%
Delivered energy.....	0.50	0.43	0.42	0.40	0.38	0.36	0.34	-0.9%
Marketed renewables (wood) ⁷	0.59	0.44	0.42	0.41	0.39	0.38	0.37	-0.7%
Kerosene	0.01	0.01	0.01	0.01	0.01	0.00	0.00	-2.6%

Table A4. Residential sector key indicators and consumption (continued)
(quadrillion Btu per year, unless otherwise noted)

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Delivered energy consumption by end use								
Space heating.....	5.40	4.55	4.58	4.43	4.31	4.22	4.13	-0.4%
Space cooling.....	0.67	0.83	0.76	0.77	0.81	0.86	0.91	0.4%
Water heating.....	1.76	1.77	1.78	1.79	1.81	1.79	1.78	0.0%
Refrigeration.....	0.36	0.36	0.34	0.33	0.33	0.34	0.36	0.0%
Cooking.....	0.34	0.34	0.35	0.36	0.37	0.38	0.39	0.5%
Clothes dryers.....	0.25	0.26	0.27	0.28	0.29	0.30	0.32	0.9%
Freezers.....	0.08	0.08	0.07	0.07	0.07	0.06	0.06	-0.7%
Lighting.....	0.51	0.50	0.43	0.37	0.30	0.25	0.23	-3.0%
Clothes washers ¹	0.03	0.03	0.02	0.02	0.02	0.02	0.02	-2.0%
Dishwashers ¹	0.09	0.09	0.10	0.10	0.11	0.12	0.13	1.2%
Televisions and related equipment ²	0.30	0.29	0.26	0.25	0.26	0.29	0.32	0.4%
Computers and related equipment ³	0.11	0.11	0.09	0.08	0.07	0.06	0.05	-3.0%
Furnace fans and boiler circulation pumps.....	0.14	0.11	0.12	0.12	0.11	0.11	0.10	-0.5%
Other uses ⁸	1.64	1.62	1.73	1.80	1.89	1.99	2.11	1.1%
Delivered energy.....	11.70	10.92	10.90	10.77	10.74	10.78	10.91	0.0%
Electricity related losses.....	9.72	9.44	9.37	9.03	8.77	8.93	9.15	-0.1%
Total energy consumption by end use								
Space heating.....	6.27	5.20	5.29	5.10	4.94	4.83	4.72	-0.4%
Space cooling.....	1.98	2.41	2.21	2.20	2.24	2.36	2.48	0.1%
Water heating.....	2.67	2.66	2.69	2.69	2.67	2.65	2.62	-0.1%
Refrigeration.....	1.09	1.06	1.01	0.96	0.93	0.95	0.98	-0.3%
Cooking.....	0.56	0.56	0.58	0.59	0.60	0.62	0.64	0.5%
Clothes dryers.....	0.67	0.66	0.69	0.70	0.71	0.74	0.77	0.6%
Freezers.....	0.23	0.22	0.21	0.20	0.18	0.18	0.18	-1.0%
Lighting.....	1.54	1.47	1.29	1.07	0.85	0.69	0.64	-3.3%
Clothes washers ¹	0.08	0.08	0.07	0.05	0.05	0.04	0.05	-2.3%
Dishwashers ¹	0.29	0.28	0.29	0.29	0.31	0.33	0.35	0.9%
Televisions and related equipment ²	0.91	0.85	0.77	0.73	0.74	0.81	0.88	0.1%
Computers and related equipment ³	0.35	0.33	0.28	0.23	0.20	0.17	0.14	-3.3%
Furnace fans and boiler circulation pumps.....	0.43	0.34	0.36	0.34	0.31	0.29	0.28	-0.8%
Other uses ⁸	4.36	4.23	4.55	4.65	4.79	5.05	5.32	0.9%
Total.....	21.42	20.37	20.27	19.79	19.50	19.71	20.05	-0.1%
Nonmarketed renewables⁹								
Geothermal heat pumps.....	0.01	0.01	0.02	0.02	0.02	0.02	0.02	2.8%
Solar hot water heating.....	0.01	0.01	0.01	0.02	0.02	0.02	0.02	3.4%
Solar photovoltaic.....	0.05	0.08	0.30	0.43	0.57	0.71	0.86	10.2%
Wind.....	0.01	0.02	0.03	0.03	0.03	0.03	0.03	2.0%
Total.....	0.08	0.11	0.35	0.50	0.63	0.78	0.94	8.8%
Heating degree days¹⁰.....	4,549	4,084	4,173	4,106	4,041	3,977	3,914	-0.2%
Cooling degree days¹⁰.....	1,299	1,488	1,456	1,503	1,551	1,599	1,648	0.4%

¹Does not include water heating portion of load.

²Includes televisions, set-top boxes, home theater systems, DVD players, and video game consoles.

³Includes desktop and laptop computers, monitors, and networking equipment.

⁴Includes small electric devices, heating elements, and motors not listed above. Electric vehicles are included in the transportation sector.

⁵Includes such appliances as outdoor grills, exterior lights, pool heaters, spa heaters, and backup electricity generators.

⁶Includes such appliances as pool heaters, spa heaters, and backup electricity generators.

⁷Includes wood used for primary and secondary heating in wood stoves or fireplaces as reported in the *Residential Energy Consumption Survey 2009*.

⁸Includes small electric devices, heating elements, outdoor grills, exterior lights, pool heaters, spa heaters, backup electricity generators, and motors not listed above. Electric vehicles are included in the transportation sector.

⁹Consumption determined by using the fossil fuel equivalent of 9,541 Btu per kilowatt-hour.

¹⁰See Table A5 for regional detail.

Btu = British thermal unit.

--- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 consumption based on: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2014 degree days based on state-level data from the National Oceanic and Atmospheric Administration's Climatic Data Center and Climate Prediction Center. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A5. Commercial sector key indicators and consumption
(quadrillion Btu per year, unless otherwise noted)

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Key indicators								
Total floorspace (billion square feet)								
Surviving.....	81.6	82.2	86.7	91.9	97.1	102.3	107.5	1.1%
New additions.....	1.5	1.7	2.1	2.1	2.2	2.3	2.3	1.4%
Total.....	83.1	83.8	88.7	94.0	99.3	104.6	109.8	1.1%
Energy consumption intensity (thousand Btu per square foot)								
Delivered energy consumption.....	107.6	105.1	101.8	97.8	95.6	94.3	93.6	-0.5%
Electricity related losses.....	112.4	109.3	104.0	98.2	92.9	91.5	90.0	-0.8%
Total energy consumption.....	220.0	214.3	205.8	196.0	188.5	185.8	183.7	-0.6%
Delivered energy consumption by fuel								
Purchased electricity								
Space heating ¹	0.16	0.14	0.14	0.13	0.13	0.13	0.13	-0.4%
Space cooling ¹	0.48	0.55	0.52	0.52	0.53	0.55	0.57	0.1%
Water heating ¹	0.09	0.09	0.09	0.09	0.09	0.08	0.08	-0.3%
Ventilation.....	0.51	0.52	0.54	0.56	0.57	0.58	0.61	0.6%
Cooking.....	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-0.1%
Lighting.....	0.89	0.88	0.87	0.83	0.81	0.76	0.74	-0.7%
Refrigeration.....	0.37	0.36	0.33	0.31	0.30	0.30	0.31	-0.6%
Office equipment (PC).....	0.09	0.08	0.06	0.05	0.04	0.03	0.02	-4.8%
Office equipment (non-PC).....	0.22	0.22	0.24	0.26	0.30	0.34	0.38	2.2%
Other uses ²	1.79	1.76	1.88	2.08	2.30	2.53	2.76	1.8%
Delivered energy.....	4.61	4.64	4.69	4.86	5.09	5.33	5.62	0.8%
Natural gas								
Space heating ¹	1.92	1.74	1.75	1.70	1.66	1.64	1.62	-0.3%
Space cooling ¹	0.03	0.04	0.04	0.04	0.04	0.04	0.04	-0.6%
Water heating ¹	0.54	0.55	0.56	0.57	0.60	0.63	0.66	0.8%
Cooking.....	0.20	0.21	0.22	0.22	0.23	0.25	0.26	0.9%
Other uses ³	0.89	0.79	0.89	0.93	1.01	1.11	1.22	1.8%
Delivered energy.....	3.58	3.32	3.45	3.46	3.53	3.66	3.81	0.5%
Distillate fuel oil								
Space heating ¹	0.16	0.16	0.15	0.14	0.13	0.11	0.10	-1.6%
Water heating ¹	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-0.1%
Other uses ⁴	0.18	0.19	0.18	0.18	0.18	0.17	0.17	-0.6%
Delivered energy.....	0.36	0.37	0.36	0.34	0.32	0.30	0.29	-1.0%
Marketed renewables (biomass).....	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.0%
Other fuels ⁵	0.26	0.34	0.40	0.41	0.42	0.42	0.43	0.9%
Delivered energy consumption by end use								
Space heating ¹	2.24	2.03	2.04	1.97	1.92	1.89	1.85	-0.4%
Space cooling ¹	0.51	0.60	0.56	0.56	0.57	0.58	0.60	0.0%
Water heating ¹	0.64	0.66	0.67	0.68	0.70	0.73	0.77	0.6%
Ventilation.....	0.51	0.52	0.54	0.56	0.57	0.58	0.61	0.6%
Cooking.....	0.23	0.23	0.24	0.25	0.26	0.27	0.28	0.8%
Lighting.....	0.89	0.88	0.87	0.83	0.81	0.76	0.74	-0.7%
Refrigeration.....	0.37	0.36	0.33	0.31	0.30	0.30	0.31	-0.6%
Office equipment (PC).....	0.09	0.08	0.06	0.05	0.04	0.03	0.02	-4.8%
Office equipment (non-PC).....	0.22	0.22	0.24	0.26	0.30	0.34	0.38	2.2%
Other uses ⁶	3.26	3.23	3.49	3.74	4.03	4.36	4.72	1.5%
Delivered energy.....	8.95	8.81	9.03	9.20	9.49	9.86	10.28	0.6%

Table A5. Commercial sector key indicators and consumption (continued)
(quadrillion Btu per year, unless otherwise noted)

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Electricity related losses	9.34	9.16	9.23	9.23	9.23	9.57	9.89	0.3%
Total energy consumption by end use								
Space heating ¹	2.57	2.32	2.32	2.22	2.16	2.12	2.08	-0.4%
Space cooling ¹	1.47	1.69	1.59	1.56	1.53	1.57	1.60	-0.2%
Water heating ¹	0.83	0.83	0.84	0.84	0.86	0.89	0.91	0.4%
Ventilation	1.55	1.54	1.61	1.62	1.60	1.63	1.67	0.3%
Cooking	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.6%
Lighting	2.68	2.62	2.58	2.41	2.27	2.12	2.04	-1.0%
Refrigeration	1.11	1.08	0.97	0.89	0.84	0.85	0.85	-0.9%
Office equipment (PC)	0.27	0.25	0.18	0.14	0.10	0.08	0.07	-5.1%
Office equipment (non-PC)	0.65	0.65	0.70	0.76	0.85	0.96	1.05	1.9%
Other uses ⁶	6.88	6.71	7.19	7.70	8.20	8.90	9.57	1.4%
Total	18.29	17.97	18.26	18.43	18.72	19.43	20.17	0.5%
Nonmarketed renewable fuels⁷								
Solar thermal	0.08	0.09	0.09	0.10	0.10	0.11	0.11	1.0%
Solar photovoltaic	0.06	0.07	0.09	0.12	0.19	0.27	0.35	6.5%
Wind	0.00	0.00	0.00	0.00	0.00	0.01	0.01	9.0%
Total	0.15	0.16	0.18	0.22	0.29	0.38	0.47	4.4%
Heating degree days								
New England	6,674	6,526	6,099	6,004	5,909	5,813	5,716	-0.5%
Middle Atlantic	6,203	5,781	5,533	5,459	5,385	5,312	5,240	-0.4%
East North Central	7,194	6,168	6,207	6,182	6,158	6,133	6,109	0.0%
West North Central	7,304	6,090	6,521	6,508	6,492	6,476	6,459	0.2%
South Atlantic.....	2,952	2,492	2,628	2,593	2,559	2,526	2,494	0.0%
East South Central.....	3,931	3,227	3,440	3,433	3,426	3,419	3,411	0.2%
West South Central.....	2,422	2,087	2,031	1,995	1,959	1,923	1,888	-0.4%
Mountain.....	4,742	4,593	4,877	4,819	4,757	4,691	4,622	0.0%
Pacific.....	2,772	2,867	3,366	3,334	3,302	3,271	3,240	0.5%
United States	4,549	4,084	4,173	4,106	4,041	3,977	3,914	-0.2%
Cooling degree days								
New England	419	557	561	589	618	647	676	0.8%
Middle Atlantic	596	799	778	810	843	875	906	0.5%
East North Central	610	728	790	804	818	832	846	0.6%
West North Central.....	814	942	985	999	1,014	1,028	1,043	0.4%
South Atlantic.....	2,008	2,390	2,169	2,205	2,241	2,278	2,313	-0.1%
East South Central.....	1,493	1,717	1,686	1,709	1,731	1,754	1,777	0.1%
West South Central.....	2,474	2,741	2,809	2,875	2,941	3,007	3,073	0.5%
Mountain.....	1,432	1,484	1,547	1,594	1,644	1,697	1,751	0.7%
Pacific.....	1,068	1,095	956	994	1,032	1,069	1,107	0.0%
United States	1,299	1,488	1,456	1,503	1,551	1,599	1,648	0.4%

¹Includes fuel consumption for district services.

²Includes (but is not limited to) miscellaneous uses such as transformers, medical imaging and other medical equipment, elevators, escalators, off-road electric vehicles, laboratory fume hoods, laundry equipment, coffee brewers, and water services.

³Includes miscellaneous uses, such as emergency generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings.

⁴Includes miscellaneous uses, such as cooking, emergency generators, and combined heat and power in commercial buildings.

⁵Includes residual fuel oil, propane, coal, motor gasoline, and kerosene.

⁶Includes (but is not limited to) miscellaneous uses such as transformers, medical imaging and other medical equipment, elevators, escalators, off-road electric vehicles, laboratory fume hoods, laundry equipment, coffee brewers, water services, emergency generators, combined heat and power in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus residual fuel oil, propane, coal, motor gasoline, kerosene, and marketed renewable fuels (biomass).

⁷Consumption determined by using the fossil fuel equivalent of 9,541 Btu per kilowatthour.

Btu = British thermal unit.

PC = Personal computer.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 consumption based on: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2014 degree days based on state-level data from the National Oceanic and Atmospheric Administration's Climatic Data Center and Climate Prediction Center. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A6. Industrial sector key indicators and consumption

Shipments, prices, and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Key indicators								
Value of shipments (billion 2009 dollars)								
Manufacturing	5,208	5,299	5,858	6,527	7,066	7,734	8,528	1.9%
Agriculture, mining, and construction	1,957	1,931	2,493	2,620	2,710	2,828	2,955	1.7%
Total	7,165	7,229	8,351	9,146	9,776	10,562	11,483	1.9%
Energy prices								
(2015 dollars per million Btu)								
Propane	18.8	12.2	15.6	16.8	17.8	19.5	21.1	2.2%
Motor gasoline	27.5	20.4	22.5	24.7	26.6	28.9	31.8	1.8%
Distillate fuel oil	27.1	17.0	19.7	22.2	24.4	27.4	30.5	2.4%
Residual fuel oil	15.0	6.8	11.3	14.2	15.9	18.2	20.6	4.6%
Asphalt and road oil	9.0	3.3	7.7	10.3	11.7	13.5	15.3	6.3%
Natural gas heat and power	5.2	3.5	5.2	5.8	5.8	5.6	5.6	1.8%
Natural gas feedstocks	5.6	3.9	5.5	6.1	6.1	5.9	5.8	1.6%
Metallurgical coal	5.3	5.4	6.0	6.5	7.0	7.2	7.3	1.2%
Other industrial coal	3.2	3.4	3.4	3.4	3.4	3.5	3.6	0.2%
Coal to liquids	--	--	--	--	--	--	--	--
Electricity	21.0	20.3	20.9	21.5	22.1	21.5	21.2	0.2%
(nominal dollars per million Btu)								
Propane	18.7	12.2	17.2	20.6	24.1	29.4	35.6	4.4%
Motor gasoline	27.2	20.4	24.9	30.2	35.9	43.7	53.6	3.9%
Distillate fuel oil	26.8	17.0	21.8	27.2	33.1	41.4	51.3	4.5%
Residual fuel oil	14.8	6.8	12.4	17.4	21.6	27.5	34.7	6.8%
Asphalt and road oil	8.9	3.3	8.5	12.6	15.9	20.4	25.8	8.5%
Natural gas heat and power	5.1	3.5	5.7	7.1	7.8	8.5	9.4	4.0%
Natural gas feedstocks	5.5	3.9	6.1	7.5	8.2	8.9	9.8	3.8%
Metallurgical coal	5.3	5.4	6.7	8.0	9.4	10.9	12.2	3.3%
Other industrial coal	3.2	3.4	3.7	4.2	4.6	5.2	6.0	2.4%
Coal to liquids	--	--	--	--	--	--	--	--
Electricity	20.8	20.3	23.1	26.3	29.9	32.5	35.7	2.3%
Energy consumption (quadrillion Btu)¹								
Industrial consumption excluding refining								
Propane heat and power	0.42	0.35	0.37	0.38	0.37	0.37	0.38	0.3%
Liquefied petroleum gas and other feedstocks ² ..	2.00	2.02	2.73	3.13	3.29	3.55	3.85	2.6%
Motor gasoline	0.27	0.27	0.28	0.27	0.27	0.27	0.27	0.0%
Distillate fuel oil	1.36	1.34	1.44	1.45	1.44	1.45	1.47	0.4%
Residual fuel oil	0.03	0.03	0.04	0.06	0.06	0.05	0.05	1.9%
Petrochemical feedstocks	0.70	0.66	0.96	1.21	1.31	1.47	1.66	3.8%
Petroleum coke	0.12	0.16	0.22	0.23	0.23	0.23	0.23	1.4%
Asphalt and road oil	0.79	0.83	0.89	0.93	1.05	1.18	1.31	1.8%
Miscellaneous petroleum ³	0.30	0.40	0.42	0.50	0.52	0.53	0.55	1.3%
Petroleum and other liquids subtotal	5.99	6.08	7.34	8.15	8.53	9.11	9.76	1.9%
Natural gas heat and power	5.74	5.61	5.94	6.19	6.33	6.59	6.87	0.8%
Natural gas feedstocks	0.63	0.68	1.22	1.41	1.45	1.52	1.59	3.5%
Lease and plant fuel ⁴	1.55	1.63	1.76	1.94	2.06	2.19	2.31	1.4%
Natural gas liquefaction for export ⁵	0.00	0.00	0.26	0.48	0.53	0.64	0.69	--
Natural gas subtotal	7.92	7.92	9.17	10.01	10.38	10.94	11.45	1.5%
Metallurgical coal and coke ⁶	0.56	0.52	0.40	0.45	0.47	0.44	0.41	-1.0%
Other industrial coal	0.85	0.79	0.82	0.86	0.88	0.89	0.93	0.6%
Coal subtotal	1.41	1.31	1.23	1.31	1.35	1.33	1.34	0.1%
Renewables ⁷	1.52	1.48	1.48	1.59	1.67	1.70	1.79	0.8%
Purchased electricity	3.21	3.07	3.42	3.73	3.81	3.91	4.08	1.1%
Delivered energy	20.04	19.87	22.65	24.79	25.73	26.99	28.42	1.4%
Electricity related losses	6.49	6.07	6.74	7.09	6.91	7.03	7.18	0.7%
Total	26.53	25.94	29.38	31.87	32.64	34.02	35.60	1.3%

Table A6. Industrial sector key indicators and consumption (continued)

Shipments, prices, and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Refining consumption								
Liquefied petroleum gas heat and power ²	0.01	0.01	0.00	0.00	0.00	0.00	0.00	--
Distillate fuel oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Residual fuel oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Petroleum coke	0.53	0.50	0.36	0.36	0.35	0.35	0.36	-1.3%
Still gas	1.45	1.48	1.70	1.68	1.67	1.67	1.69	0.6%
Miscellaneous petroleum ³	0.01	0.01	0.00	0.00	0.00	0.00	0.01	1.9%
Petroleum and other liquids subtotal	2.00	2.00	2.06	2.04	2.02	2.02	2.06	0.1%
Natural gas heat and power	1.29	1.25	1.09	1.04	1.04	1.06	1.10	-0.5%
Natural gas feedstocks	0.19	0.22	0.31	0.30	0.31	0.32	0.34	1.8%
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Natural gas subtotal	1.48	1.46	1.39	1.33	1.35	1.39	1.44	-0.1%
Other industrial coal	0.02	0.02	0.00	0.00	0.00	0.00	0.00	--
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Coal subtotal	0.02	0.02	0.00	0.00	0.00	0.00	0.00	--
Biofuels heat and coproducts	0.75	0.78	0.83	0.80	0.81	0.81	0.84	0.3%
Purchased electricity	0.20	0.20	0.19	0.18	0.17	0.17	0.18	-0.4%
Delivered energy	4.45	4.47	4.46	4.36	4.34	4.39	4.52	0.0%
Electricity related losses	0.40	0.39	0.37	0.33	0.31	0.31	0.32	-0.8%
Total	4.85	4.86	4.84	4.69	4.65	4.70	4.84	0.0%
Total industrial sector consumption								
Liquefied petroleum gas heat and power ²	0.43	0.36	0.37	0.38	0.37	0.37	0.38	0.2%
Liquefied petroleum gas and other feedstocks ² ..	2.00	2.02	2.73	3.13	3.29	3.55	3.85	2.6%
Motor gasoline	0.27	0.27	0.28	0.27	0.27	0.27	0.27	0.0%
Distillate fuel oil	1.36	1.34	1.44	1.45	1.44	1.45	1.47	0.4%
Residual fuel oil	0.03	0.04	0.04	0.06	0.06	0.05	0.05	1.6%
Petrochemical feedstocks	0.70	0.66	0.96	1.21	1.31	1.47	1.66	3.8%
Petroleum coke	0.65	0.67	0.57	0.59	0.58	0.58	0.59	-0.5%
Asphalt and road oil	0.79	0.83	0.89	0.93	1.05	1.18	1.31	1.8%
Still gas	1.45	1.48	1.70	1.68	1.67	1.67	1.69	0.6%
Miscellaneous petroleum ³	0.30	0.41	0.42	0.50	0.52	0.53	0.56	1.3%
Petroleum and other liquids subtotal	7.99	8.07	9.40	10.19	10.55	11.13	11.82	1.5%
Natural gas heat and power	7.03	6.85	7.03	7.23	7.37	7.65	7.96	0.6%
Natural gas feedstocks	0.81	0.90	1.52	1.70	1.76	1.84	1.93	3.1%
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Lease and plant fuel ⁴	1.55	1.63	1.76	1.94	2.06	2.19	2.31	1.4%
Natural gas liquefaction for export ⁵	0.00	0.00	0.26	0.48	0.53	0.64	0.69	--
Natural gas subtotal	9.40	9.38	10.57	11.34	11.72	12.32	12.89	1.3%
Metallurgical coal and coke ⁶	0.56	0.52	0.40	0.45	0.47	0.44	0.41	-1.0%
Other industrial coal	0.87	0.82	0.82	0.86	0.88	0.89	0.93	0.5%
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Coal subtotal	1.43	1.34	1.23	1.31	1.35	1.33	1.34	0.0%
Biofuels heat and coproducts	0.75	0.78	0.83	0.80	0.81	0.81	0.84	0.3%
Renewables ⁷	1.52	1.48	1.48	1.59	1.67	1.70	1.79	0.8%
Purchased electricity	3.40	3.27	3.61	3.91	3.98	4.08	4.26	1.1%
Delivered energy	24.49	24.33	27.11	29.14	30.07	31.38	32.94	1.2%
Electricity related losses	6.89	6.46	7.11	7.42	7.22	7.34	7.50	0.6%
Total	31.38	30.79	34.22	36.56	37.29	38.72	40.44	1.1%

Table A6. Industrial sector key indicators and consumption (continued)

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Energy consumption per dollar of shipments (thousand Btu per 2009 dollar)								
Petroleum and other liquids	1.12	1.12	1.13	1.11	1.08	1.05	1.03	-0.3%
Natural gas	1.31	1.30	1.27	1.24	1.20	1.17	1.12	-0.6%
Coal	0.20	0.19	0.15	0.14	0.14	0.13	0.12	-1.8%
Renewable fuels ⁷	0.32	0.31	0.28	0.26	0.25	0.24	0.23	-1.2%
Purchased electricity	0.48	0.45	0.43	0.43	0.41	0.39	0.37	-0.8%
Delivered energy	3.42	3.37	3.25	3.19	3.08	2.97	2.87	-0.6%
Industrial combined heat and power¹								
Capacity (gigawatts)	25.7	25.8	27.0	28.9	31.5	34.3	36.0	1.3%
Generation (billion kilowatthours)	138	139	158	168	182	196	206	1.6%

¹Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

²Includes ethane, natural gasoline, and refinery olefins.

³Includes lubricants and miscellaneous petroleum products.

⁴Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.

⁵Fuel used in facilities that liquefy natural gas for export.

⁶Includes net coal coke imports.

⁷Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources.

Btu = British thermal unit.

-- = Not applicable.

Note: Includes estimated consumption for petroleum and other liquids. Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 prices for motor gasoline and distillate fuel oil are based on: U.S. Energy Information Administration (EIA), *Petroleum Marketing Monthly*, January 2015-December 2015. 2014 petrochemical feedstock and asphalt and road oil prices are based on: EIA, *State Energy Data Report 2013*. 2014 coal prices are based on: EIA, *Quarterly Coal Report, October-December 2014* and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. 2014 electricity prices: EIA, *Monthly Energy Review*, February 2016. 2014 natural gas prices: *Natural Gas Monthly*, July 2015. 2014 refining consumption based on: *Petroleum Supply Annual 2014*. Other 2014 consumption values are based on: EIA, *Monthly Energy Review*, February 2016. 2014 shipments: IHS Economics, Industry model, November 2015. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A7. Transportation sector key indicators and delivered energy consumption

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Key indicators								
Travel indicators								
(billion vehicle miles traveled)								
Light-duty vehicles less than 8,501 pounds	2,665	2,752	3,031	3,126	3,232	3,336	3,438	0.9%
Commercial light trucks ¹	94	96	110	118	125	133	143	1.6%
Freight trucks greater than 10,000 pounds	270	280	304	329	349	375	407	1.5%
(billion seat miles available)								
Air	1,053	1,070	1,168	1,261	1,364	1,452	1,531	1.4%
(billion ton miles traveled)								
Rail	1,690	1,690	1,810	1,956	2,006	2,054	2,128	0.9%
Domestic shipping	497	482	453	423	404	402	407	-0.7%
Energy efficiency indicators								
(miles per gallon)								
New light-duty vehicle CAFE standard ²	30.9	31.5	36.2	46.1	46.4	46.6	46.9	1.6%
New car ²	34.9	36.0	43.7	54.3	54.3	54.3	54.3	1.7%
New light truck ²	26.9	27.9	30.9	39.5	39.5	39.5	39.5	1.4%
Compliance new light-duty vehicle ³	31.6	31.7	37.0	46.5	47.2	47.6	47.8	1.7%
New car ³	36.0	36.3	44.2	54.6	55.1	55.2	55.1	1.7%
New light truck ³	27.3	28.0	31.8	40.1	40.4	40.5	40.4	1.5%
Tested new light-duty vehicle ⁴	30.8	30.9	36.9	46.5	47.2	47.6	47.8	1.8%
New car ⁴	35.6	35.9	44.2	54.6	55.1	55.2	55.1	1.7%
New light truck ⁴	26.1	27.0	31.7	40.0	40.4	40.5	40.4	1.6%
On-road new light-duty vehicle ⁵	24.9	25.0	29.8	37.6	38.2	38.5	38.6	1.8%
New car ⁵	29.1	29.3	36.1	44.6	45.0	45.1	45.0	1.7%
New light truck ⁵	20.9	21.6	25.4	32.1	32.3	32.4	32.3	1.6%
Light-duty stock ⁶	21.4	21.7	24.1	27.6	31.5	34.4	36.3	2.1%
New commercial light truck ¹	17.0	17.3	19.5	23.7	24.0	24.1	24.0	1.3%
Stock commercial light truck ¹	14.8	15.0	16.6	18.7	20.8	22.2	23.2	1.7%
Freight truck	6.9	6.9	7.3	7.6	7.8	7.9	8.0	0.6%
(seat miles per gallon)								
Aircraft	65.9	66.1	67.5	68.7	70.1	71.9	74.1	0.5%
(ton miles per thousand Btu)								
Rail	3.5	3.5	3.6	3.8	3.9	4.1	4.2	0.7%
Domestic shipping	4.8	4.8	5.0	5.2	5.4	5.6	5.8	0.8%
Energy use by mode								
(quadrillion Btu)								
Light-duty vehicles	15.60	15.86	15.73	14.12	12.82	12.10	11.83	-1.2%
Commercial light trucks ¹	0.80	0.80	0.82	0.79	0.75	0.75	0.77	-0.1%
Bus transportation	0.26	0.26	0.27	0.28	0.29	0.30	0.31	0.6%
Freight trucks	5.39	5.57	5.76	5.96	6.16	6.52	6.98	0.9%
Rail, passenger	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.9%
Rail, freight	0.49	0.48	0.50	0.52	0.51	0.51	0.51	0.2%
Shipping, domestic	0.11	0.10	0.09	0.08	0.08	0.07	0.07	-1.4%
Shipping, international	0.64	0.73	0.64	0.68	0.70	0.73	0.74	0.1%
Recreational boats	0.24	0.25	0.27	0.28	0.29	0.29	0.30	0.8%
Air	2.35	2.37	2.52	2.66	2.82	2.93	3.00	0.9%
Military use	0.65	0.65	0.65	0.66	0.69	0.73	0.78	0.8%
Lubricants	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.2%
Pipeline fuel	0.87	0.89	0.83	0.89	0.94	1.00	1.07	0.7%
Total	27.56	28.14	28.28	27.11	26.24	26.13	26.57	-0.2%

Table A7. Transportation sector key indicators and delivered energy consumption (*continued*)

Key indicators and consumption	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Energy use by mode								
(million barrels per day oil equivalent)								
Light-duty vehicles	8.45	8.60	8.52	7.66	6.98	6.60	6.47	-1.1%
Commercial light trucks ¹	0.42	0.42	0.43	0.41	0.39	0.39	0.40	-0.2%
Bus transportation	0.13	0.13	0.13	0.14	0.14	0.14	0.15	0.6%
Freight trucks	2.59	2.67	2.77	2.87	2.96	3.14	3.36	0.9%
Rail, passenger	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.9%
Rail, freight	0.23	0.23	0.24	0.25	0.24	0.24	0.24	0.2%
Shipping, domestic	0.05	0.05	0.04	0.04	0.04	0.03	0.03	-1.4%
Shipping, international	0.29	0.33	0.29	0.31	0.31	0.33	0.34	0.1%
Recreational boats	0.13	0.13	0.14	0.15	0.16	0.16	0.16	0.8%
Air	1.14	1.15	1.22	1.29	1.36	1.42	1.45	0.9%
Military use	0.31	0.31	0.31	0.31	0.33	0.35	0.38	0.8%
Lubricants	0.06	0.06	0.07	0.06	0.07	0.07	0.07	0.2%
Pipeline fuel	0.41	0.42	0.39	0.42	0.44	0.47	0.51	0.7%
Total	14.23	14.52	14.57	13.92	13.45	13.36	13.58	-0.3%

¹Commercial trucks 8,501 to 10,000 pounds gross vehicle weight rating.

²CAFE standard based on projected new vehicle sales.

³Includes CAFE credits for alternative fueled vehicle sales and credit banking.

⁴Environmental Protection Agency rated miles per gallon.

⁵Tested new vehicle efficiency revised for on-road performance.

⁶Combined "on-the-road" estimate for all cars and light trucks.

CAFE = Corporate average fuel economy.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016; EIA, Alternatives to Traditional Transportation Fuels 2009 (Part II - User and Fuel Data), April 2011; Federal Highway Administration, *Highway Statistics 2012*; Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 34*; National Highway Traffic and Safety Administration, *Summary of Fuel Economy Performance* June 2015; U.S. Department of Commerce, Bureau of the Census, "Vehicle Inventory and Use Survey," EC02TV; EIA, U.S. Department of Transportation, Research and Special Programs Administration, *Air Carrier Statistics Monthly, December 2010/2009*; and United States Department of Defense, Defense Fuel Supply Center, Factbook January, 2010. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A8. Electricity supply, disposition, prices, and emissions
(billion kilowatthours, unless otherwise noted)

Supply, disposition, prices, and emissions	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Net generation by fuel type								
Electric power sector¹								
Power only²								
Coal	1,549	1,320	1,355	1,145	938	928	884	-1.6%
Petroleum	26	23	13	11	9	8	7	-4.6%
Natural gas ³	911	1,114	947	1,129	1,412	1,460	1,618	1.5%
Nuclear power	797	798	777	789	789	789	789	0.0%
Pumped storage/other ⁴	1	3	3	3	3	3	3	0.1%
Renewable sources ⁵	505	493	757	918	969	1,094	1,205	3.6%
Distributed generation (natural gas)	0	0	0	1	1	1	2	--
Total	3,790	3,751	3,853	3,996	4,121	4,284	4,508	0.7%
Combined heat and power⁶								
Coal	20	23	21	21	21	21	21	-0.4%
Petroleum	2	1	1	1	1	1	1	0.0%
Natural gas	120	136	143	143	147	142	139	0.1%
Renewable sources	4	4	4	4	4	4	4	0.1%
Total	150	164	168	169	173	169	165	0.0%
Total net electric power sector generation.....	3,939	3,915	4,021	4,165	4,294	4,452	4,673	0.7%
Less direct use	16	18	18	17	17	17	17	-0.1%
Net available to the grid	3,924	3,897	4,004	4,148	4,276	4,435	4,656	0.7%
End-use sector⁷								
Coal	12	12	12	13	13	13	14	0.6%
Petroleum	2	2	1	1	1	1	2	-0.4%
Natural gas	97	99	111	124	143	165	183	2.5%
Other gaseous fuels ⁸	11	11	21	21	21	21	21	2.5%
Renewable sources ⁹	45	49	75	93	115	139	165	5.0%
Other ¹⁰	3	3	3	3	3	3	3	0.0%
Total end-use sector net generation	170	176	223	255	296	343	387	3.2%
Less direct use	121	127	181	210	246	286	324	3.8%
Total sales to the grid	49	49	42	45	51	57	63	1.0%
Total net electricity generation by fuel								
Coal	1,582	1,355	1,388	1,179	972	962	919	-1.5%
Petroleum	30	26	15	13	11	10	9	-4.0%
Natural gas	1,129	1,348	1,201	1,396	1,702	1,768	1,942	1.5%
Nuclear power	797	798	777	789	789	789	789	0.0%
Renewable sources ^{5,9}	554	546	836	1,015	1,088	1,238	1,374	3.8%
Other ¹¹	18	17	27	27	27	27	27	1.8%
Total net electricity generation	4,109	4,090	4,244	4,420	4,590	4,795	5,060	0.9%
Net generation to the grid	3,972	3,946	4,046	4,193	4,327	4,492	4,719	0.7%
Net imports	52	57	57	58	50	46	43	-1.1%
Electricity sales by sector								
Residential	1,407	1,402	1,395	1,393	1,416	1,457	1,523	0.3%
Commercial	1,352	1,360	1,374	1,425	1,491	1,562	1,647	0.8%
Industrial	998	959	1,059	1,145	1,166	1,197	1,249	1.1%
Transportation	8	9	13	23	32	40	45	6.7%
Total	3,765	3,729	3,841	3,986	4,105	4,256	4,464	0.7%
Direct use	137	144	199	227	263	303	341	3.5%
Total electricity use	3,902	3,873	4,039	4,213	4,368	4,559	4,805	0.9%

Table A8. Electricity supply, disposition, prices, and emissions (continued)
(billion kilowatthours, unless otherwise noted)

Supply, disposition, prices, and emissions	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
End-use prices								
(2015 cents per kilowatthour)								
Residential	12.7	12.4	12.9	13.2	13.4	13.2	13.0	0.2%
Commercial	10.9	10.5	10.7	10.9	11.0	10.7	10.5	0.0%
Industrial	7.2	6.9	7.1	7.3	7.5	7.3	7.2	0.2%
Transportation.....	11.0	10.1	11.3	12.3	12.7	12.4	12.1	0.7%
All sectors average.....	10.5	10.3	10.5	10.7	10.9	10.6	10.5	0.1%
(nominal cents per kilowatthour)								
Residential	12.5	12.4	14.2	16.2	18.2	19.9	21.9	2.3%
Commercial	10.7	10.5	11.9	13.4	14.9	16.2	17.6	2.1%
Industrial	7.1	6.9	7.9	9.0	10.2	11.1	12.2	2.3%
Transportation.....	10.9	10.1	12.5	15.1	17.2	18.8	20.4	2.9%
All sectors average.....	10.4	10.3	11.6	13.1	14.7	16.1	17.6	2.2%
Prices by service category								
(2015 cents per kilowatthour)								
Generation	6.8	6.4	6.4	6.8	7.3	6.8	6.6	0.1%
Transmission	1.0	1.1	1.2	1.2	1.3	1.3	1.3	0.7%
Distribution.....	2.7	2.8	3.0	2.7	2.3	2.6	2.6	-0.3%
(nominal cents per kilowatthour)								
Generation	6.7	6.4	7.0	8.4	9.9	10.3	11.1	2.2%
Transmission	1.0	1.1	1.3	1.5	1.7	1.9	2.2	2.8%
Distribution.....	2.7	2.8	3.3	3.3	3.2	3.9	4.4	1.8%
Electric power sector emissions¹								
Sulfur dioxide (million short tons).....	4.05	3.57	1.20	1.07	0.77	0.84	0.79	-5.9%
Nitrogen oxide (million short tons)	1.63	1.41	1.16	1.00	0.91	0.90	0.88	-1.9%
Mercury (short tons).....	26.77	23.74	5.55	4.62	3.76	3.82	3.57	-7.3%

¹Includes electricity-only and combined heat and power plants that have a regulatory status.

²Includes plants that only produce electricity and that have a regulatory status.

³Includes electricity generation from fuel cells.

⁴Includes non-biogenic municipal waste. The U.S. Energy Information Administration estimates that in 2015 approximately 7 billion kilowatthours of electricity were generated from a municipal waste stream containing petroleum-derived plastics and other non-renewable sources. See U.S. Energy Information Administration, *Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy*, (Washington, DC, May 2007).

⁵Includes conventional hydroelectric, geothermal, wood, wood waste, biogenic municipal waste, landfill gas, other biomass, solar, and wind power.

⁶Includes combined heat and power plants whose primary business is to sell electricity and heat to the public (i.e., those that report North American Industry Classification System code 22 or that have a regulatory status).

⁷Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors that have a non-regulatory status; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

⁸Includes refinery gas and still gas.

⁹Includes conventional hydroelectric, geothermal, wood, wood waste, all municipal waste, landfill gas, other biomass, solar, and wind power.

¹⁰Includes batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

¹¹Includes pumped storage, non-biogenic municipal waste, refinery gas, still gas, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 electric power sector generation; sales to the grid; net imports; electricity sales; and electricity end-use prices: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016, and supporting databases. 2014 emissions: U.S. Environmental Protection Agency, Clean Air Markets Database. 2014 electricity prices by service category: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A9. Electricity generating capacity
(gigawatts)

Net summer capacity ¹	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Electric power sector²								
Power only³								
Coal ⁴	290.8	277.7	208.4	189.3	177.0	172.2	169.5	-2.0%
Oil and natural gas steam ^{4,5}	91.9	91.0	89.9	65.6	54.0	52.4	52.4	-2.2%
Combined cycle.....	198.1	202.3	220.6	231.5	267.7	287.9	318.7	1.8%
Combustion turbine/diesel.....	138.7	138.3	140.1	137.4	134.2	136.8	141.8	0.1%
Nuclear power ⁶	99.1	99.8	99.1	99.1	99.1	99.1	99.1	0.0%
Pumped storage.....	22.6	22.6	22.6	22.6	22.6	22.6	22.6	0.0%
Fuel cells.....	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0%
Renewable sources ⁷	162.1	176.2	237.7	287.3	304.3	356.1	398.4	3.3%
Distributed generation (natural gas) ⁸	0.0	0.0	0.2	0.5	1.0	1.8	2.9	--
Total	1,003.4	1,007.8	1,018.7	1,033.4	1,060.0	1,128.9	1,205.3	0.7%
Combined heat and power⁹								
Coal.....	3.8	3.7	3.3	3.3	3.3	3.3	3.3	-0.4%
Oil and natural gas steam ⁵	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0%
Combined cycle.....	25.1	25.0	26.8	26.7	26.7	26.7	26.7	0.3%
Combustion turbine/diesel.....	2.9	2.9	2.9	2.9	2.9	2.9	2.9	0.0%
Renewable sources ⁷	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.0%
Total	33.1	32.9	34.4	34.3	34.3	34.3	34.3	0.2%
Cumulative planned additions¹⁰								
Coal.....	--	--	0.3	0.3	0.3	0.3	0.3	--
Oil and natural gas steam ⁵	--	--	0.0	0.0	0.0	0.0	0.0	--
Combined cycle.....	--	--	21.5	21.5	21.5	21.5	21.5	--
Combustion turbine/diesel.....	--	--	5.0	5.0	5.0	5.0	5.0	--
Nuclear power.....	--	--	4.4	4.4	4.4	4.4	4.4	--
Pumped storage.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Fuel cells.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Renewable sources ⁷	--	--	19.7	19.7	19.7	19.7	19.7	--
Distributed generation ⁸	--	--	0.0	0.0	0.0	0.0	0.0	--
Total	--	--	50.8	50.8	50.8	50.8	50.8	--
Cumulative unplanned additions¹⁰								
Coal.....	--	--	0.2	0.2	0.2	0.2	0.2	--
Oil and natural gas steam ⁵	--	--	0.0	0.0	0.0	0.0	0.0	--
Combined cycle.....	--	--	5.2	26.0	63.4	85.1	117.2	--
Combustion turbine/diesel.....	--	--	2.3	2.4	3.0	7.0	14.5	--
Nuclear power.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Pumped storage.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Fuel cells.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Renewable sources ⁷	--	--	42.3	91.8	108.9	160.7	203.1	--
Distributed generation ⁸	--	--	0.2	0.5	1.0	1.8	2.9	--
Total	--	--	50.3	121.0	176.6	254.8	337.8	--
Cumulative electric power sector additions¹⁰ ..	--	--	101.1	171.8	227.4	305.6	388.6	--
Cumulative retirements¹¹								
Coal.....	--	--	61.6	79.7	92.1	96.9	99.6	--
Oil and natural gas steam ⁵	--	--	9.7	34.9	46.4	48.1	48.1	--
Combined cycle.....	--	--	6.5	16.5	17.7	19.2	20.5	--
Combustion turbine/diesel.....	--	--	5.5	8.3	12.2	13.5	16.0	--
Nuclear power.....	--	--	5.2	5.2	5.2	5.2	5.2	--
Pumped storage.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Fuel cells.....	--	--	0.0	0.0	0.0	0.0	0.0	--
Renewable sources ⁷	--	--	0.4	0.4	0.4	0.5	0.5	--
Total	--	--	88.9	144.9	174.0	183.3	189.8	--
Total electric power sector capacity	1,037	1,041	1,053	1,068	1,094	1,163	1,240	0.7%

Table A9. Electricity generating capacity (continued)
(gigawatts)

Net summer capacity ¹	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
End-use generators¹²								
Coal	2.9	2.9	2.9	3.0	3.1	3.2	3.3	0.5%
Petroleum	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.0%
Natural gas	16.2	16.5	17.4	19.7	22.9	26.6	29.5	2.4%
Other gaseous fuels ¹³	2.4	2.4	3.0	3.0	3.0	3.0	3.0	1.0%
Renewable sources ⁷	15.0	18.4	36.6	49.1	63.6	80.3	97.4	6.9%
Other ¹⁴	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0%
Total	37.8	41.3	61.1	76.0	93.9	114.4	134.5	4.8%
Cumulative capacity additions¹⁰	--	--	21.0	35.9	53.8	74.2	94.3	--

¹Net summer capacity is the steady hourly output that generating equipment is expected to supply to system load (exclusive of auxiliary power), as demonstrated by tests during summer peak demand.

²Includes electricity-only and combined heat and power plants that have a regulatory status.

³Includes plants that only produce electricity and that have a regulatory status. Includes capacity increases (uprates) at existing units.

⁴Total coal and oil and natural gas steam capacity account for the conversion of coal capacity to gas steam capacity, but the conversions are not included explicitly as additions or retirements. The totals reflect 8.8 gigawatts of planned conversions as well as additional model-projected conversions.

⁵Includes oil-, gas-, and dual-fired capacity.

⁶Nuclear capacity includes 0.1 gigawatts of uprates.

⁷Includes conventional hydroelectric, geothermal, wood, wood waste, all municipal waste, landfill gas, other biomass, solar, and wind power. Facilities co-firing biomass and coal are classified as coal.

⁸Primarily peak load capacity fueled by natural gas.

⁹Includes combined heat and power plants whose primary business is to sell electricity and heat to the public (i.e., those that report North American Industry Classification System code 22 or that have a regulatory status).

¹⁰Cumulative additions after December 31, 2015.

¹¹Cumulative retirements after December 31, 2015.

¹²Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors that have a non-regulatory status; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

¹³Includes refinery gas and still gas.

¹⁴Includes batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 capacity and projected planned additions: U.S. Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report" (preliminary). 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A10. Electricity trade
(billion kilowatthours, unless otherwise noted)

Electricity trade	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Interregional electricity trade								
Gross domestic sales								
Firm power.....	105	102	95	92	73	53	49	-2.9%
Economy.....	165	233	216	257	239	226	222	-0.2%
Total.....	271	336	311	349	312	278	270	-0.9%
Gross domestic sales (million 2015 dollars)								
Firm power.....	6,761	6,568	6,088	5,871	4,683	3,375	3,120	-2.9%
Economy.....	8,385	7,704	9,139	12,921	13,756	11,896	11,460	1.6%
Total.....	15,147	14,273	15,227	18,792	18,439	15,270	14,580	0.1%
International electricity trade								
Imports from Canada and Mexico								
Firm power.....	20.3	28.3	29.5	28.5	26.6	23.2	20.2	-1.4%
Economy.....	45.3	37.5	41.0	43.8	37.6	36.0	35.9	-0.2%
Total.....	65.6	65.9	70.5	72.4	64.2	59.2	56.1	-0.6%
Exports to Canada and Mexico								
Firm power.....	2.6	1.8	1.8	1.8	0.9	0.0	0.0	--
Economy.....	10.6	7.5	11.9	12.7	13.0	13.2	13.2	2.3%
Total.....	13.3	9.3	13.7	14.5	13.9	13.2	13.2	1.4%

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports. Firm power sales are capacity sales, meaning the delivery of the power is scheduled as part of the normal operating conditions of the affected electric systems. Economy sales are subject to curtailment or cessation of delivery by the supplier in accordance with prior agreements or under specified conditions.

Sources: 2014 interregional firm electricity trade data: Federal Energy Regulatory Commission, Form 1, "Electric Utility Annual Report", and 2014 seasonal reliability assessments from North American Electric Reliability Council regional entities and Independent System Operators, and Federal Energy Regulatory Commission, Form 1. 2014 interregional economy electricity trade are model results. 2014 Mexican electricity trade data: U.S. Energy Information Administration (EIA), *Electric Power Annual 2014*. 2014 Canadian international electricity trade data: National Energy Board, *Electricity Exports and Imports Statistics, 2014*. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A11. Petroleum and other liquids supply and disposition
(million barrels per day, unless otherwise noted)

Supply and disposition	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Crude oil								
Domestic crude production ¹	8.71	9.42	9.38	9.43	10.06	10.66	11.26	0.7%
Alaska.....	0.50	0.48	0.41	0.32	0.24	0.19	0.15	-4.7%
Lower 48 states.....	8.21	8.94	8.96	9.12	9.82	10.48	11.11	0.9%
Net imports.....	6.99	6.88	6.97	6.95	6.57	6.24	6.10	-0.5%
Gross imports.....	7.35	7.28	7.60	7.58	7.20	7.07	7.12	-0.1%
Exports.....	0.35	0.40	0.63	0.63	0.63	0.83	1.02	3.8%
Other crude supply ²	0.15	-0.11	0.01	0.07	0.00	0.00	0.00	--
Total crude supply	15.85	16.19	16.36	16.46	16.63	16.91	17.36	0.3%
Net product imports.....	-1.90	-2.24	-3.26	-3.69	-4.32	-4.52	-4.66	3.0%
Gross refined product imports ³	0.78	0.66	1.11	1.24	1.30	1.44	1.63	3.7%
Unfinished oil imports.....	0.55	0.55	0.53	0.50	0.46	0.43	0.39	-1.4%
Blending component imports.....	0.55	0.67	0.58	0.52	0.45	0.35	0.30	-3.2%
Exports.....	3.76	4.12	5.48	5.95	6.52	6.74	6.98	2.1%
Refinery processing gain ⁴	1.08	1.03	1.05	1.01	0.98	0.97	0.99	-0.2%
Product stock withdrawal.....	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	--
Natural gas plant liquids.....	3.02	3.25	4.57	4.77	4.90	4.95	4.99	1.7%
Supply from renewable sources.....	0.96	1.01	1.08	1.03	1.03	1.05	1.12	0.4%
Ethanol.....	0.86	0.89	0.89	0.85	0.84	0.86	0.93	0.2%
Domestic production.....	0.91	0.94	0.90	0.87	0.87	0.88	0.91	-0.1%
Net imports.....	-0.05	-0.05	-0.01	-0.03	-0.03	-0.03	0.02	--
Stock withdrawal.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Biodiesel.....	0.10	0.11	0.15	0.10	0.10	0.10	0.10	-0.5%
Domestic production.....	0.08	0.08	0.11	0.06	0.06	0.06	0.06	-1.6%
Net imports.....	0.02	0.03	0.04	0.04	0.04	0.04	0.04	1.7%
Stock withdrawal.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Other biomass-derived liquids ⁵	0.00	0.00	0.04	0.09	0.09	0.09	0.09	18.1%
Domestic production.....	0.00	0.00	0.04	0.09	0.09	0.09	0.09	18.1%
Net imports.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Stock withdrawal.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Liquids from gas.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Liquids from coal.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Other ⁶	0.21	0.21	0.28	0.28	0.30	0.31	0.32	1.7%
Total primary supply ⁷	19.04	19.46	20.08	19.87	19.52	19.66	20.12	0.1%
Product supplied								
by fuel								
Liquefied petroleum gases and other ⁸	2.45	2.46	2.90	3.22	3.34	3.55	3.80	1.8%
Motor gasoline ⁹	8.94	9.18	8.97	8.08	7.35	6.96	6.84	-1.2%
of which: E85 ¹⁰	0.02	0.03	0.03	0.09	0.15	0.18	0.19	7.3%
Jet fuel ¹¹	1.47	1.54	1.56	1.64	1.73	1.80	1.86	0.8%
Distillate fuel oil ¹²	4.04	3.96	4.31	4.40	4.46	4.57	4.67	0.7%
of which: Diesel.....	3.83	3.76	3.97	4.10	4.19	4.32	4.43	0.7%
Residual fuel oil.....	0.26	0.26	0.25	0.27	0.27	0.28	0.28	0.2%
Other ¹³	2.01	2.02	2.11	2.29	2.39	2.53	2.70	1.2%
by sector								
Residential and commercial.....	0.93	0.90	0.89	0.84	0.80	0.77	0.74	-0.8%
Industrial ¹⁴	4.46	4.47	5.35	5.88	6.10	6.46	6.89	1.8%
Transportation.....	13.76	14.04	14.11	13.40	12.84	12.65	12.69	-0.4%
Electric power ¹⁵	0.14	0.12	0.07	0.06	0.05	0.04	0.04	-4.3%
Unspecified sector ¹⁶	-0.31	-0.30	-0.31	-0.28	-0.25	-0.23	-0.23	-1.1%
Total product supplied	19.16	19.42	20.11	19.90	19.54	19.69	20.14	0.1%
Discrepancy ¹⁷	-0.12	0.04	-0.03	-0.03	-0.03	-0.03	-0.03	--

Table A11. Petroleum and other liquids supply and disposition (continued)
(million barrels per day, unless otherwise noted)

Supply and disposition	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Domestic refinery distillation capacity ¹⁸	17.9	18.0	19.0	19.0	19.0	19.0	19.0	0.2%
Capacity utilization rate (percent) ¹⁹	90.4	91.1	87.7	88.2	88.9	90.2	92.5	0.1%
Net import share of product supplied (percent).....	26.6	23.7	18.6	16.5	11.6	8.8	7.4	-4.5%
Net expenditures for imported crude oil and petroleum products (billion 2015 dollars)	262	128	207	250	268	303	348	4.1%

¹Includes lease condensate.

²Strategic petroleum reserve stock additions plus unaccounted for crude oil and crude oil stock withdrawals.

³Includes other hydrocarbons and alcohols.

⁴The volumetric amount by which total output is greater than input due to the processing of crude oil into products which, in total, have a lower specific gravity than the crude oil processed.

⁵Includes pyrolysis oils, biomass-derived Fischer-Tropsch liquids, biobutanol, and renewable feedstocks used for the on-site production of diesel and gasoline.

⁶Includes domestic sources of other blending components, other hydrocarbons, and ethers.

⁷Total crude supply, net product imports, refinery processing gain, product stock withdrawal, natural gas plant liquids, supply from renewable sources, liquids from gas, liquids from coal, and other supply.

⁸Includes ethane, natural gasoline, and refinery olefins.

⁹Includes ethanol and ethers blended into gasoline.

¹⁰E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

¹¹Includes only kerosene type.

¹²Includes distillate fuel oil from petroleum and biomass feedstocks.

¹³Includes kerosene, aviation gasoline, petrochemical feedstocks, lubricants, waxes, asphalt, road oil, still gas, special naphthas, petroleum coke, crude oil product supplied, methanol, and miscellaneous petroleum products.

¹⁴Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

¹⁵Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

¹⁶Represents consumption unattributed to the sectors above.

¹⁷Balancing item. Includes unaccounted for supply, losses, and gains.

¹⁸End-of-year operable capacity.

¹⁹Rate is calculated by dividing the gross annual input to atmospheric crude oil distillation units by their operable refining capacity in barrels per calendar day.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 product supplied based on: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. Other 2014 data: EIA, *Petroleum Supply Annual 2014*. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A12. Petroleum and other liquids prices
(2015 dollars per gallon, unless otherwise noted)

Sector and fuel	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Crude oil prices (2015 dollars per barrel)								
Brent spot	100	52	77	92	104	120	136	3.9%
West Texas Intermediate spot	94	49	71	85	97	112	129	4.0%
Average imported refiners acquisition cost ¹	91	46	69	83	95	110	126	4.1%
Brent / West Texas Intermediate spread	5.8	3.7	5.4	6.2	6.9	7.2	7.1	2.7%
Delivered sector product prices								
Residential								
Propane	2.13	1.55	1.84	1.95	2.04	2.19	2.33	1.7%
Distillate fuel oil	3.71	2.66	3.08	3.51	3.82	4.23	4.65	2.3%
Commercial								
Distillate fuel oil	3.63	2.34	2.71	3.05	3.36	3.77	4.19	2.4%
Residual fuel oil	2.50	1.04	1.64	2.02	2.29	2.63	2.98	4.3%
Residual fuel oil (2015 dollars per barrel)	105	44	69	85	96	110	125	4.3%
Industrial²								
Propane	1.72	1.12	1.42	1.54	1.63	1.78	1.93	2.2%
Distillate fuel oil	3.72	2.34	2.71	3.05	3.36	3.76	4.19	2.4%
Residual fuel oil	2.24	1.01	1.68	2.13	2.39	2.73	3.08	4.6%
Residual fuel oil (2015 dollars per barrel)	94	42	71	89	100	115	130	4.6%
Transportation								
Propane	2.23	1.64	1.94	2.05	2.14	2.28	2.43	1.6%
E85 ³	3.15	2.21	3.05	2.97	2.93	3.08	3.33	1.6%
Ethanol wholesale price	2.25	2.22	2.77	2.38	2.28	2.39	2.60	0.6%
Motor gasoline ⁴	3.42	2.52	2.74	2.97	3.19	3.47	3.81	1.7%
Jet fuel ⁵	2.81	1.62	2.18	2.56	2.87	3.30	3.74	3.4%
Diesel fuel (distillate fuel oil) ⁶	3.82	2.72	3.18	3.55	3.85	4.25	4.68	2.2%
Residual fuel oil	2.19	1.21	1.75	2.01	2.25	2.54	2.87	3.5%
Residual fuel oil (2015 dollars per barrel)	92	51	73	85	94	107	121	3.5%
Electric power⁷								
Distillate fuel oil	3.27	2.07	2.53	2.92	3.23	3.63	4.04	2.7%
Residual fuel oil	2.73	1.53	2.06	2.43	2.70	3.03	3.36	3.2%
Residual fuel oil (2015 dollars per barrel)	115	64	87	102	114	127	141	3.2%
Average prices, all sectors⁸								
Propane	1.94	1.36	1.65	1.75	1.83	1.97	2.12	1.8%
Motor gasoline ⁴	3.42	2.52	2.74	2.97	3.19	3.47	3.81	1.7%
Jet fuel ⁵	2.81	1.62	2.18	2.56	2.87	3.30	3.74	3.4%
Distillate fuel oil	3.78	2.63	3.07	3.44	3.75	4.16	4.58	2.2%
Residual fuel oil	2.37	1.26	1.76	2.06	2.30	2.60	2.93	3.4%
Residual fuel oil (2015 dollars per barrel)	99	53	74	87	97	109	123	3.4%
Average	3.12	2.18	2.44	2.65	2.85	3.13	3.42	1.8%

Table A12. Petroleum and other liquids prices (continued)
(nominal dollars per gallon, unless otherwise noted)

Sector and fuel	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Crude oil prices (nominal dollars per barrel)								
Brent spot	99	52	85	112	141	181	229	6.1%
West Texas Intermediate spot	93	49	79	105	131	170	217	6.2%
Average imported refiners acquisition cost ¹	90	46	76	102	128	166	212	6.3%
Delivered sector product prices								
Residential								
Propane	2.11	1.55	2.03	2.39	2.76	3.30	3.93	3.8%
Distillate fuel oil	3.67	2.66	3.40	4.29	5.16	6.39	7.83	4.4%
Commercial								
Distillate fuel oil	3.59	2.34	2.99	3.74	4.54	5.69	7.04	4.5%
Residual fuel oil	2.47	1.04	1.81	2.47	3.09	3.97	5.02	6.5%
Residual fuel oil (nominal dollars per barrel)	104	44	76	104	130	167	211	6.5%
Industrial²								
Propane	1.70	1.12	1.57	1.88	2.20	2.69	3.25	4.4%
Distillate fuel oil	3.68	2.34	2.99	3.74	4.54	5.69	7.04	4.5%
Residual fuel oil	2.22	1.01	1.86	2.60	3.23	4.12	5.19	6.8%
Residual fuel oil (nominal dollars per barrel)	93	42	78	109	136	173	218	6.8%
Transportation								
Propane	2.21	1.64	2.14	2.51	2.89	3.45	4.09	3.7%
E85 ³	3.12	2.21	3.37	3.63	3.97	4.65	5.60	3.8%
Ethanol wholesale price	2.23	2.22	3.06	2.91	3.09	3.62	4.38	2.8%
Motor gasoline ⁴	3.38	2.52	3.02	3.64	4.32	5.25	6.40	3.8%
Jet fuel ⁵	2.78	1.62	2.41	3.14	3.89	4.99	6.29	5.6%
Diesel fuel (distillate fuel oil) ⁶	3.78	2.72	3.51	4.34	5.21	6.43	7.88	4.3%
Residual fuel oil	2.17	1.21	1.93	2.46	3.04	3.84	4.83	5.7%
Residual fuel oil (nominal dollars per barrel)	91	51	81	103	128	161	203	5.7%
Electric power⁷								
Distillate fuel oil	3.24	2.07	2.80	3.57	4.37	5.48	6.79	4.9%
Residual fuel oil	2.71	1.53	2.28	2.98	3.66	4.57	5.65	5.4%
Residual fuel oil (nominal dollars per barrel)	114	64	96	125	154	192	237	5.4%
Average prices, all sectors⁸								
Propane	1.92	1.36	1.82	2.14	2.48	2.98	3.56	3.9%
Motor gasoline ⁴	3.38	2.52	3.02	3.64	4.32	5.24	6.40	3.8%
Jet fuel ⁵	2.78	1.62	2.41	3.14	3.89	4.99	6.29	5.6%
Distillate fuel oil	3.75	2.63	3.39	4.22	5.08	6.28	7.71	4.4%
Residual fuel oil	2.34	1.26	1.94	2.52	3.11	3.93	4.93	5.6%
Residual fuel oil (nominal dollars per barrel)	98	53	81	106	131	165	207	5.6%
Average	3.09	2.18	2.70	3.25	3.86	4.72	5.76	4.0%

¹Weighted average price delivered to U.S. refiners.

²Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

³E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

⁴Sales weighted-average price for all grades. Includes Federal, State, and local taxes.

⁵Includes only kerosene type.

⁶Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes.

⁷Includes electricity-only and combined heat and power plants that have a regulatory status.

⁸Weighted averages of end-use fuel prices are derived from the prices in each sector and the corresponding sectoral consumption.

Note: Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 Brent and West Texas Intermediate crude oil spot prices: Thomson Reuters. 2014 average imported crude oil price: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2014 prices for motor gasoline, distillate fuel oil, and jet fuel are based on: EIA, *Petroleum Marketing Monthly*, January 2105-December 2015. 2014 residential, commercial, industrial, and transportation sector petroleum product prices are derived from: EIA, Form EIA-782A, "Refiners/Gas Plant Operators' Monthly Petroleum Product Sales Report." 2014 electric power prices based on: EIA, *Monthly Energy Review*, February 2016. 2014 E85 prices derived from: U.S. Department of Energy, Clean Cities Alternative Fuel Price Report. 2014 wholesale ethanol prices derived from Bloomberg U.S. average rack price. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A13. Natural gas supply, disposition, and prices
(trillion cubic feet, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Supply								
Dry gas production ¹	25.73	27.19	30.50	34.81	37.76	39.92	42.12	1.8%
Supplemental natural gas ²	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.3%
Net imports	1.18	0.95	-2.89	-5.32	-6.02	-7.18	-7.55	--
Pipeline ³	1.14	0.89	-0.48	-0.76	-0.97	-0.99	-0.89	--
Liquefied natural gas	0.04	0.06	-2.42	-4.56	-5.06	-6.19	-6.66	--
Total supply	26.97	28.20	27.67	29.55	31.80	32.80	34.63	0.8%
Consumption by sector								
Residential	5.09	4.62	4.71	4.67	4.65	4.62	4.58	0.0%
Commercial	3.47	3.22	3.34	3.35	3.42	3.55	3.69	0.5%
Industrial ⁴	7.60	7.51	8.29	8.65	8.85	9.19	9.58	1.0%
Natural-gas-to-liquids heat and power ⁵	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Natural gas to liquids production ⁶	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Electric power ⁷	8.14	9.61	8.26	9.33	11.02	11.13	11.96	0.9%
Transportation ⁸	0.06	0.06	0.09	0.14	0.22	0.38	0.66	9.8%
Pipeline fuel	0.84	0.86	0.81	0.86	0.91	0.97	1.04	0.7%
Lease and plant fuel ⁹	1.50	1.58	1.71	1.88	2.00	2.12	2.24	1.4%
Liquefaction for export ¹⁰	0.00	0.00	0.25	0.46	0.51	0.63	0.67	--
Total consumption	26.70	27.47	27.46	29.35	31.59	32.59	34.42	0.9%
Discrepancy ¹¹	0.27	0.73	0.21	0.21	0.21	0.21	0.21	--
Natural gas spot price at Henry Hub								
(2015 dollars per million Btu)	4.44	2.62	4.43	5.12	5.06	4.91	4.86	2.5%
(nominal dollars per million Btu)	4.39	2.62	4.90	6.27	6.84	7.42	8.17	4.7%
Delivered prices								
(2015 dollars per thousand cubic feet)								
Residential	11.08	10.40	11.08	11.99	12.41	12.50	12.74	0.8%
Commercial	9.24	7.92	9.58	10.39	10.72	10.66	10.73	1.2%
Industrial ⁴	5.57	3.84	5.53	6.15	6.14	5.95	5.89	1.7%
Electric power ⁷	5.20	3.35	4.83	5.55	5.74	5.54	5.52	2.0%
Transportation ¹²	19.03	17.18	17.18	16.90	16.05	15.87	16.37	-0.2%
Average ¹³	7.15	5.42	6.95	7.58	7.65	7.55	7.59	1.4%
(nominal dollars per thousand cubic feet)								
Residential	10.96	10.40	12.24	14.67	16.78	18.87	21.44	2.9%
Commercial	9.15	7.92	10.59	12.72	14.51	16.09	18.05	3.4%
Industrial ⁴	5.51	3.84	6.11	7.53	8.31	8.98	9.91	3.9%
Electric power ⁷	5.15	3.35	5.33	6.80	7.76	8.36	9.29	4.2%
Transportation ¹²	18.83	17.18	18.98	20.68	21.71	23.96	27.54	1.9%
Average ¹³	7.08	5.42	7.67	9.28	10.35	11.40	12.77	3.5%

¹Marketed production (wet) minus extraction losses.

²Synthetic natural gas, propane air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.

³Includes any natural gas regasified in the Bahamas and transported via pipeline to Florida, as well as gas from Canada and Mexico.

⁴Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems. Excludes use for lease and plant fuel.

⁵Includes any natural gas used in the process of converting natural gas to liquid fuel that is not actually converted.

⁶Includes any natural gas converted into liquid fuel.

⁷Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

⁸Natural gas used as fuel in motor vehicles, trains, and ships.

⁹Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.

¹⁰Fuel used in facilities that liquefy natural gas for export.

¹¹Balancing item. Natural gas lost as a result of converting flow data measured at varying temperatures and pressures to a standard temperature and pressure and the merger of different data reporting systems which vary in scope, format, definition, and respondent type. In addition, 2014 and 2015 values include net storage injections.

¹²Natural gas used as fuel in motor vehicles, trains, and ships. Price includes estimated motor vehicle fuel taxes and estimated dispensing costs or charges.

¹³Weighted average prices. Weights used are the sectoral consumption values excluding lease, plant, and pipeline fuel.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 supply values; lease, plant, and pipeline fuel consumption; and residential, commercial, and industrial delivered prices: U.S. Energy Information Administration (EIA), *Natural Gas Monthly*, July 2015. Other 2014 consumption based on: EIA, *Monthly Energy Review*, February 2016. 2014 natural gas spot price at Henry Hub: Thomson Reuters. 2014 electric power prices: EIA, *Electric Power Monthly*, April 2014 and April 2015, Table 4.2, and EIA, *State Energy Data Report 2013*. 2014 transportation sector delivered prices derived from: U.S. Department of Energy, Clean Cities Alternative Fuel Price Report. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A14. Oil and gas supply

Production and supply	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Crude oil								
Lower 48 average wellhead price¹								
(2015 dollars per barrel).....	88	49	74	88	99	114	130	4.0%
Production (million barrels per day)²								
United States total	8.71	9.42	9.38	9.43	10.06	10.66	11.26	0.7%
Lower 48 onshore	6.71	7.30	6.99	7.38	8.22	8.85	9.53	1.1%
Tight oil ³	4.28	4.89	5.08	5.51	6.25	6.72	7.08	1.5%
Carbon dioxide enhanced oil recovery.....	0.28	0.28	0.32	0.43	0.55	0.63	0.72	3.8%
Other.....	2.15	2.13	1.59	1.44	1.41	1.50	1.73	-0.8%
Lower 48 offshore.....	1.50	1.64	1.98	1.74	1.60	1.63	1.58	-0.2%
State	0.07	0.07	0.05	0.04	0.04	0.03	0.03	-3.6%
Federal	1.43	1.57	1.92	1.69	1.57	1.60	1.55	0.0%
Alaska.....	0.50	0.48	0.41	0.32	0.24	0.19	0.15	-4.7%
Onshore.....	0.40	0.41	0.28	0.22	0.17	0.14	0.11	-5.0%
State offshore	0.10	0.07	0.13	0.10	0.07	0.05	0.03	-3.2%
Federal offshore.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.7%
Natural gas plant liquids production								
(million barrels per day)								
United States total	3.02	3.25	4.57	4.77	4.90	4.96	4.99	1.7%
Lower 48 onshore	2.65	2.86	4.15	4.39	4.50	4.51	4.54	1.9%
Lower 48 offshore	0.34	0.37	0.40	0.36	0.39	0.44	0.44	0.8%
Alaska.....	0.03	0.03	0.02	0.02	0.01	0.01	0.01	-4.9%
Natural gas								
Natural gas spot price at Henry Hub								
(2015 dollars per million Btu).....	4.44	2.62	4.43	5.12	5.06	4.91	4.86	2.5%
Dry production (trillion cubic feet)⁴								
United States total	25.73	27.19	30.50	34.81	37.76	39.92	42.12	1.8%
Lower 48 onshore	24.05	25.20	28.82	33.31	36.15	37.99	40.18	1.9%
Tight gas.....	4.81	5.00	4.92	5.43	6.08	6.30	6.55	1.1%
Shale gas and tight oil plays ³	12.29	13.64	17.96	22.50	25.16	27.04	29.00	3.1%
Coalbed methane	1.16	1.24	1.04	1.02	0.94	0.85	0.78	-1.9%
Other.....	5.79	5.32	4.90	4.36	3.97	3.79	3.85	-1.3%
Lower 48 offshore.....	1.36	1.70	1.39	1.21	1.33	1.65	1.67	-0.1%
State	0.10	0.14	0.07	0.04	0.03	0.02	0.02	-7.3%
Federal	1.25	1.56	1.32	1.17	1.30	1.63	1.64	0.2%
Alaska.....	0.32	0.29	0.29	0.29	0.28	0.28	0.28	-0.2%
Onshore.....	0.32	0.29	0.29	0.29	0.28	0.28	0.28	-0.2%
State offshore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Federal offshore.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Supplemental gas supplies (trillion cubic feet)⁵	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.3%
Total lower 48 wells drilled (thousands).....	47.4	32.3	32.3	36.8	41.8	44.6	47.4	1.5%

¹Represents lower 48 onshore and offshore supplies.

²Includes lease condensate.

³Tight oil represents resources in low-permeability reservoirs, including shale and chalk formations. The specific plays included in the tight oil category are Bakken/Three Forks/Sanish, Eagle Ford, Woodford, Austin Chalk, Spraberry, Niobrara, Avalon/Bone Springs, and Monterey.

⁴Marketed production (wet) minus extraction losses.

⁵Synthetic natural gas, propane air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 crude oil lower 48 average wellhead price: U.S. Energy Information Administration (EIA), *Petroleum Marketing Monthly*, January 2105-December 2015. 2014 lower 48 onshore, lower 48 offshore, and Alaska crude oil production: EIA, *Petroleum Supply Annual 2014*. 2014 natural gas spot price at Henry Hub: Thomson Reuters. 2014 Alaska and total natural gas production, and supplemental gas supplies: EIA, *Natural Gas Monthly*, July 2015. Other 2014: EIA, Office of Energy Analysis. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A15. Coal supply, disposition, and prices
(million short tons, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Production¹								
Appalachia	270	223	202	165	138	154	144	-1.7%
Interior	190	165	197	193	148	172	170	0.1%
West	542	484	473	408	378	335	329	-1.5%
East of the Mississippi	413	346	351	307	243	281	276	-0.9%
West of the Mississippi	590	526	521	460	422	380	367	-1.4%
Total	1,002	873	872	766	664	661	643	-1.2%
Waste coal supplied²	9	9	11	9	9	8	9	-0.3%
Net imports								
Imports ³	11	11	0	0	0	0	0	-19.2%
Exports	97	75	70	70	74	87	94	0.9%
Total	-86	-63	-70	-70	-74	-87	-94	1.6%
Total supply⁴	925	819	813	705	599	583	557	-1.5%
Consumption by sector								
Commercial and institutional	2	3	2	2	2	2	2	-0.4%
Coke plants	20	19	14	16	16	15	14	-1.2%
Other industrial ⁵	43	40	42	44	45	45	47	0.6%
Coal-to-liquids heat and power	0	0	0	0	0	0	0	--
Coal to liquids production	0	0	0	0	0	0	0	--
Electric power ⁶	852	739	754	643	536	520	494	-1.6%
Total	917	801	813	705	599	583	557	-1.4%
Discrepancy and stock change⁷	8	17	0	0	0	0	0	--
Average minemouth price⁸								
(2015 dollars per short ton)	35.2	33.8	33.6	34.0	33.8	37.6	38.7	0.5%
(2015 dollars per million Btu)	1.73	1.69	1.68	1.71	1.71	1.86	1.91	0.5%
Delivered prices⁹								
(2015 dollars per short ton)								
Commercial and institutional	91.2	85.6	85.0	86.0	85.7	87.2	89.2	0.2%
Coke plants	153.0	153.7	173.4	186.8	200.2	207.3	208.1	1.2%
Other industrial ⁵	68.9	69.7	70.6	71.5	71.2	72.3	74.9	0.3%
Coal to liquids	--	--	--	--	--	--	--	--
Electric power ⁶								
(2015 dollars per short ton)	46.1	41.6	43.1	42.7	41.8	43.8	45.2	0.3%
(2015 dollars per million Btu)	2.38	2.19	2.26	2.26	2.26	2.32	2.38	0.3%
Average	49.7	45.8	47.0	47.8	48.5	50.4	51.9	0.5%
Exports ¹⁰	85.3	86.7	84.0	81.7	81.2	84.8	83.9	-0.1%

Table A15. Coal supply, disposition, and prices (continued)
(million short tons, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Average minemouth price⁸								
(nominal dollars per short ton)	34.9	33.8	37.1	41.6	45.8	56.8	65.1	2.7%
(nominal dollars per million Btu).....	1.71	1.69	1.86	2.09	2.31	2.81	3.21	2.6%
Delivered prices⁹								
(nominal dollars per short ton)								
Commercial and institutional.....	90.3	85.6	93.9	105.2	116.0	131.6	150.0	2.3%
Coke plants.....	151.4	153.7	191.6	228.7	270.9	313.1	350.2	3.3%
Other industrial ⁵	68.2	69.7	78.0	87.5	96.3	109.2	126.0	2.4%
Coal to liquids.....	--	--	--	--	--	--	--	--
Electric power ⁶								
(nominal dollars per short ton).....	45.7	41.6	47.6	52.3	56.5	66.1	76.0	2.4%
(nominal dollars per million Btu).....	2.35	2.19	2.50	2.77	3.05	3.50	4.01	2.5%
Average.....	49.2	45.8	51.9	58.6	65.5	76.1	87.3	2.6%
Exports ¹⁰	84.4	86.7	92.8	100.0	109.8	128.0	141.2	2.0%

¹Includes anthracite, bituminous coal, subbituminous coal, and lignite.

²Includes waste coal consumed by the electric power and industrial sectors. Waste coal supplied is counted as a supply-side item to balance the same amount of waste coal included in the consumption data.

³Excludes imports to Puerto Rico and the U.S. Virgin Islands.

⁴Production plus waste coal supplied plus net imports.

⁵Includes consumption for combined heat and power plants that have a non-regulatory status, and small on-site generating systems. Excludes all coal use in the coal-to-liquids process.

⁶Includes all electricity-only and combined heat and power plants that have a regulatory status.

⁷Balancing item: the sum of production, net imports, and waste coal supplied minus total consumption.

⁸Includes reported prices for both open market and captive mines. Prices weighted by production, which differs from average minemouth prices published in EIA data reports where it is weighted by reported sales.

⁹Prices weighted by consumption; weighted average excludes commercial and institutional prices, and export free-alongside-ship prices.

¹⁰Free-alongside-ship price at U.S. port of exit.

-- = Not applicable.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 data based on: U.S. Energy Information Administration (EIA), *Annual Coal Report 2013*; EIA, *Quarterly Coal Report, October-December 2014*; and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A16. Renewable energy generating capacity and generation
(gigawatts, unless otherwise noted)

Net summer capacity and generation	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Electric power sector¹								
Net summer capacity								
Conventional hydroelectric power.....	79.0	79.2	79.8	80.0	80.1	80.1	80.4	0.1%
Geothermal ²	2.5	2.5	3.1	4.5	5.6	6.7	7.2	4.3%
Municipal waste ³	3.7	3.8	3.9	3.9	3.9	3.9	3.9	0.0%
Wood and other biomass ⁴	3.4	3.4	3.6	3.6	3.6	3.7	4.1	0.7%
Solar thermal.....	1.9	2.0	2.5	2.5	2.5	2.5	2.5	0.8%
Solar photovoltaic ⁵	8.4	11.7	25.5	52.5	67.6	117.6	155.6	10.9%
Wind.....	64.1	74.4	120.4	141.3	142.0	142.6	145.7	2.7%
Offshore wind.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Total electric power sector capacity.....	163.0	177.1	238.7	288.2	305.2	357.0	399.4	3.3%
Generation (billion kilowatthours)								
Conventional hydroelectric power.....	262.3	245.5	292.7	293.7	294.2	294.8	296.3	0.8%
Geothermal ²	15.9	16.7	21.5	32.6	42.3	51.4	55.5	4.9%
Biogenic municipal waste ⁶	17.6	19.4	20.9	20.8	20.8	21.7	21.9	0.5%
Wood and other biomass.....	15.1	6.2	9.4	13.1	14.8	13.8	17.7	4.3%
Dedicated plants.....	14.0	5.4	8.7	12.4	14.1	13.1	17.0	4.7%
Cofiring.....	1.1	0.7	0.7	0.7	0.7	0.7	0.7	-0.3%
Solar thermal.....	2.5	3.3	4.5	4.6	4.6	4.7	4.8	1.5%
Solar photovoltaic ⁵	15.0	18.8	47.8	107.5	143.5	256.2	345.0	12.3%
Wind.....	180.9	187.5	364.5	449.9	453.1	456.0	468.3	3.7%
Offshore wind.....	0.0	0.0	0.1	0.1	0.1	0.1	0.1	--
Total electric power sector generation.....	509.2	497.4	761.4	922.2	973.4	1,098.6	1,209.5	3.6%
End-use sectors⁷								
Net summer capacity								
Conventional hydroelectric power.....	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0%
Geothermal.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Municipal waste ⁸	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0%
Biomass.....	4.7	4.7	4.7	4.9	5.0	5.0	5.0	0.3%
Solar photovoltaic ⁵	8.6	11.2	28.7	41.0	55.1	71.5	88.3	8.6%
Wind.....	0.9	1.6	2.3	2.4	2.6	2.9	3.2	2.8%
Total end-use sector capacity.....	15.0	18.4	36.6	49.1	63.6	80.3	97.4	6.9%
Generation (billion kilowatthours)								
Conventional hydroelectric power.....	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.0%
Geothermal.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Municipal waste ⁸	4.1	4.1	4.1	4.1	4.1	4.1	4.1	0.0%
Biomass.....	26.1	26.0	25.9	26.6	27.4	27.4	27.6	0.2%
Solar photovoltaic ⁵	11.8	15.5	40.2	58.1	78.7	102.7	127.2	8.8%
Wind.....	1.2	2.1	3.1	3.1	3.5	3.9	4.3	3.0%
Total end-use sector generation.....	44.5	49.0	74.6	93.2	115.0	139.4	164.6	5.0%

Table A16. Renewable energy generating capacity and generation (continued)
(gigawatts, unless otherwise noted)

Net summer capacity and generation	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Total, all sectors								
Net summer capacity								
Conventional hydroelectric power.....	79.3	79.5	80.1	80.3	80.3	80.4	80.7	0.1%
Geothermal.....	2.5	2.5	3.1	4.5	5.6	6.7	7.2	4.3%
Municipal waste.....	4.3	4.4	4.4	4.4	4.4	4.4	4.4	0.0%
Wood and other biomass ⁴	8.1	8.1	8.3	8.4	8.6	8.7	9.1	0.5%
Solar ⁵	18.9	24.9	56.6	95.9	125.3	191.6	246.4	9.6%
Wind.....	65.0	76.0	122.7	143.7	144.6	145.5	149.0	2.7%
Total capacity, all sectors.....	178.1	195.4	275.3	337.3	368.8	437.3	496.8	3.8%
Generation (billion kilowatthours)								
Conventional hydroelectric power.....	263.6	246.8	294.1	295.0	295.6	296.1	297.6	0.8%
Geothermal.....	15.9	16.7	21.5	32.6	42.3	51.4	55.5	4.9%
Municipal waste.....	21.7	23.5	25.0	24.9	24.9	25.8	26.0	0.4%
Wood and other biomass.....	41.2	32.1	35.3	39.7	42.2	41.2	45.2	1.4%
Solar ⁵	29.3	37.6	92.5	170.1	226.8	363.6	477.1	10.7%
Wind.....	182.1	189.6	367.6	453.2	456.7	459.9	472.8	3.7%
Total generation, all sectors.....	553.7	546.4	836.0	1,015.5	1,088.4	1,238.1	1,374.1	3.8%

¹Includes electricity-only and combined heat and power plants that have a regulatory status.

²Includes both hydrothermal resources (hot water and steam) and near-field enhanced geothermal systems (EGS). Near-field EGS potential occurs on known hydrothermal sites, however this potential requires the addition of external fluids for electricity generation and is only available after 2025.

³Includes municipal waste, landfill gas, and municipal sewage sludge. Incremental growth is assumed to be for landfill gas facilities. All municipal waste is included, although a portion of the municipal waste stream contains petroleum-derived plastics and other non-renewable sources.

⁴Facilities co-firing biomass and coal are classified as coal.

⁵Does not include off-grid photovoltaics (PV). Based on annual PV shipments from 1989 through 2015, EIA estimates that as much as 274 megawatts of remote electricity generation PV applications (i.e., off-grid power systems) were in service in 2015, plus an additional 573 megawatts in communications, transportation, and assorted other non-grid-connected, specialized applications. See U.S. Energy Information Administration, *Annual Energy Review 2011*, DOE/EIA-0384(2011) (Washington, DC, September 2012), Table 10.9 (annual PV shipments, 1989-2010), and Table 12 (U.S. photovoltaic module shipments by end use, sector, and type) in U.S. Energy Information Administration, *Solar Photovoltaic Cell/Module Shipments Report, 2011* (Washington, DC, September 2012) and U.S. Energy Information Administration, *Solar Photovoltaic Cell/Module Shipments Report, 2012* (Washington, DC, December 2013). The approach used to develop the estimate, based on shipment data, provides an upper estimate of the size of the PV stock, including both grid-based and off-grid PV. It will overestimate the size of the stock, because shipments include a substantial number of units that are exported, and each year some of the PV units installed earlier will be retired from service or abandoned.

⁶Includes biogenic municipal waste, landfill gas, and municipal sewage sludge. Incremental growth is assumed to be for landfill gas facilities. Only biogenic municipal waste is included. The U.S. Energy Information Administration estimates that in 2015 approximately 7 billion kilowatthours of electricity were generated from a municipal waste stream containing petroleum-derived plastics and other non-renewable sources. See U.S. Energy Information Administration, *Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy* (Washington, DC, May 2007).

⁷Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors that have a non-regulatory status; and small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

⁸Includes municipal waste, landfill gas, and municipal sewage sludge. All municipal waste is included, although a portion of the municipal waste stream contains petroleum-derived plastics and other non-renewable sources.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 capacity: U.S. Energy Information Administration (EIA), Form EIA-860, "Annual Electric Generator Report" (preliminary). 2014 generation: EIA, *Monthly Energy Review*, February 2016. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A17. Renewable energy consumption by sector and source
(quadrillion Btu per year)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Marketed renewable energy¹								
Residential (wood)	0.59	0.44	0.42	0.41	0.39	0.38	0.37	-0.7%
Commercial (biomass)	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.0%
Industrial²	2.26	2.26	2.30	2.39	2.47	2.52	2.63	0.6%
Conventional hydroelectric power.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Municipal waste ³	0.19	0.20	0.22	0.23	0.23	0.24	0.26	1.1%
Biomass.....	1.32	1.29	1.25	1.35	1.43	1.46	1.53	0.7%
Biofuels heat and coproducts.....	0.75	0.78	0.83	0.80	0.81	0.81	0.84	0.3%
Transportation	1.30	1.38	1.53	1.48	1.47	1.50	1.59	0.6%
Ethanol used in E85 ⁴	0.02	0.03	0.03	0.08	0.14	0.18	0.18	7.3%
Ethanol used in gasoline blending.....	1.09	1.12	1.12	1.01	0.94	0.93	1.01	-0.4%
Biodiesel used in distillate blending.....	0.19	0.22	0.30	0.19	0.19	0.19	0.19	-0.5%
Biobutanol.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
Liquids from biomass.....	0.00	0.00	0.00	0.00	0.01	0.01	0.01	--
Renewable diesel and gasoline ⁵	0.00	0.00	0.08	0.19	0.19	0.19	0.19	17.9%
Electric power⁶	5.01	4.86	7.37	8.91	9.41	10.60	11.67	3.6%
Conventional hydroelectric power.....	2.50	2.34	2.79	2.80	2.81	2.81	2.83	0.8%
Geothermal.....	0.15	0.16	0.21	0.31	0.41	0.49	0.53	4.9%
Biogenic municipal waste ⁷	0.24	0.25	0.28	0.28	0.28	0.29	0.29	0.6%
Biomass.....	0.23	0.10	0.15	0.21	0.24	0.22	0.27	3.9%
Dedicated plants.....	0.15	0.06	0.09	0.13	0.15	0.14	0.18	4.7%
Cofiring.....	0.08	0.05	0.06	0.08	0.09	0.08	0.09	2.7%
Solar thermal.....	0.02	0.03	0.04	0.04	0.04	0.04	0.05	1.5%
Solar photovoltaic.....	0.14	0.18	0.46	1.03	1.37	2.44	3.29	12.3%
Wind.....	1.73	1.79	3.43	4.24	4.27	4.30	4.41	3.7%
Total marketed renewable energy	9.31	9.08	11.76	13.32	13.88	15.13	16.40	2.4%
Sources of ethanol								
from corn and other starch.....	1.18	1.21	1.16	1.12	1.12	1.13	1.17	-0.1%
from cellulose.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.4%
Net imports.....	-0.07	-0.06	-0.01	-0.04	-0.04	-0.03	0.02	--
Total	1.11	1.15	1.15	1.09	1.09	1.11	1.20	0.2%

Table A17. Renewable energy consumption by sector and source (continued)
(quadrillion Btu per year)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Nonmarketed renewable energy⁸								
Selected consumption								
Residential	0.08	0.11	0.35	0.50	0.63	0.78	0.94	8.8%
Solar hot water heating.....	0.01	0.01	0.01	0.02	0.02	0.02	0.02	3.4%
Geothermal heat pumps	0.01	0.01	0.02	0.02	0.02	0.02	0.02	2.8%
Solar photovoltaic	0.05	0.08	0.30	0.43	0.57	0.71	0.86	10.2%
Wind	0.01	0.02	0.03	0.03	0.03	0.03	0.03	2.0%
Commercial	0.15	0.16	0.18	0.22	0.29	0.38	0.47	4.4%
Solar thermal	0.08	0.09	0.09	0.10	0.10	0.11	0.11	1.0%
Solar photovoltaic	0.06	0.07	0.09	0.12	0.19	0.27	0.35	6.5%
Wind	0.00	0.00	0.00	0.00	0.00	0.01	0.01	9.0%

¹Includes nonelectric renewable energy groups for which the energy source is bought and sold in the marketplace, although all transactions may not necessarily be marketed, and marketed renewable energy inputs for electricity entering the marketplace on the electric power grid. Excludes electricity imports; see Table A2. Actual heat rates used to determine fuel consumption for all renewable fuels except hydroelectric, geothermal, solar, and wind. Consumption at hydroelectric, solar, and wind facilities is determined by using the fossil fuel equivalent of 9,541 Btu per kilowatthour.

²Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

³Includes municipal waste, landfill gas, and municipal sewage sludge. All municipal waste is included, although a portion of the municipal waste stream contains petroleum-derived plastics and other non-renewable sources.

⁴Excludes motor gasoline component of E85.

⁵Renewable feedstocks for the on-site production of diesel and gasoline.

⁶Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

⁷Includes biogenic municipal waste, landfill gas, and municipal sewage sludge. Incremental growth is assumed to be for landfill gas facilities. Only biogenic municipal waste is included. The U.S. Energy Information Administration estimates that in 2015 approximately 0.3 quadrillion Btus were consumed from a municipal waste stream containing petroleum-derived plastics and other non-renewable sources. See U.S. Energy Information Administration, *Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy* (Washington, DC, May 2007).

⁸Includes selected renewable energy consumption data for which the energy is not bought or sold, either directly or indirectly as an input to marketed energy. The U.S. Energy Information Administration does not estimate or project total consumption of nonmarketed renewable energy.

-- Not applicable.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 ethanol: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2014 electric power sector: EIA, Form EIA-860, "Annual Electric Generator Report" (preliminary). Other 2014 values: EIA, Office of Energy Analysis. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A18. Energy-related carbon dioxide emissions by sector and source
(million metric tons, unless otherwise noted)

Sector and source	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Residential								
Petroleum	69	64	59	53	49	45	41	-1.7%
Natural gas	278	253	258	256	255	253	251	0.0%
Electricity ¹	765	711	664	586	538	531	529	-1.2%
Total residential	1,112	1,028	981	895	841	829	821	-0.9%
Commercial								
Petroleum	39	47	50	49	49	48	47	0.0%
Natural gas	189	176	183	184	188	194	202	0.5%
Coal	5	6	5	5	5	5	5	-0.4%
Electricity ¹	735	690	654	599	566	569	572	-0.7%
Total commercial	968	918	893	836	807	817	826	-0.4%
Industrial²								
Petroleum	341	378	410	431	434	443	458	0.8%
Natural gas ³	476	478	524	560	579	609	636	1.2%
Coal	138	130	120	128	131	130	131	0.0%
Electricity ¹	542	486	504	481	443	436	434	-0.5%
Total industrial	1,497	1,472	1,558	1,600	1,587	1,618	1,660	0.5%
Transportation								
Petroleum ⁴	1,777	1,800	1,802	1,720	1,652	1,629	1,628	-0.4%
Natural gas ⁵	48	51	49	55	62	74	93	2.4%
Electricity ¹	4	5	6	10	12	15	16	5.1%
Total transportation	1,829	1,855	1,857	1,784	1,726	1,717	1,737	-0.3%
Electric power⁶								
Petroleum	26	20	11	10	8	7	6	-4.4%
Natural gas	444	524	451	509	602	608	653	0.9%
Coal	1,570	1,340	1,360	1,150	943	930	885	-1.6%
Other ⁷	6	6	6	6	6	6	6	0.0%
Total electric power	2,046	1,891	1,829	1,675	1,559	1,551	1,551	-0.8%
Total by fuel								
Petroleum ⁴	2,252	2,309	2,332	2,262	2,191	2,171	2,181	-0.2%
Natural gas	1,434	1,482	1,466	1,563	1,685	1,737	1,835	0.9%
Coal	1,713	1,476	1,485	1,283	1,079	1,065	1,021	-1.5%
Other ⁷	6	6	6	6	6	6	6	0.0%
Total	5,406	5,273	5,289	5,115	4,961	4,980	5,044	-0.2%
Carbon dioxide emissions								
(tons per person)	16.9	16.4	15.8	14.7	13.8	13.4	13.3	-0.8%

¹Emissions from the electric power sector are distributed to the end-use sectors.

²Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

³Includes lease and plant fuel.

⁴This includes carbon dioxide from international bunker fuels, both civilian and military, which are excluded from the accounting of carbon dioxide emissions under the United Nations convention. From 1990 through 2015, international bunker fuels accounted for 90 to 126 million metric tons annually.

⁵Includes pipeline fuel natural gas and natural gas used as fuel in motor vehicles, trains, and ships.

⁶Includes electricity-only and combined heat and power plants that have a regulatory status.

⁷Includes emissions from geothermal power and nonbiogenic emissions from municipal waste.

Note: By convention, the direct emissions from biogenic energy sources are excluded from energy-related carbon dioxide emissions. The release of carbon from these sources is assumed to be balanced by the uptake of carbon when the feedstock is grown, resulting in zero net emissions over some period of time. If, however, increased use of biomass energy results in a decline in terrestrial carbon stocks, a net positive release of carbon may occur. See Table A19, "Energy-Related Carbon Dioxide Emissions by End Use", for the emissions from biogenic energy sources as an indication of the potential net release of carbon dioxide in the absence of offsetting sequestration. Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 emissions and emission factors: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A19. Energy-related carbon dioxide emissions by end use
(million metric tons)

Sector and end use	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Residential								
Space heating.....	314	262	263	248	237	230	223	-0.6%
Space cooling.....	104	120	104	94	89	90	92	-1.1%
Water heating.....	143	139	136	129	124	121	118	-0.6%
Refrigeration.....	57	53	47	41	37	36	36	-1.5%
Cooking.....	30	29	29	28	27	28	28	-0.1%
Clothes dryers.....	35	33	33	30	29	29	29	-0.5%
Freezers.....	12	11	10	8	7	7	6	-2.2%
Lighting.....	81	74	60	45	33	26	24	-4.4%
Clothes washers ¹	4	4	3	2	2	2	2	-3.4%
Dishwashers ¹	15	14	13	12	12	13	13	-0.3%
Televisions and related equipment ²	48	42	36	31	29	31	32	-1.1%
Computers and related equipment ³	18	17	13	10	8	7	5	-4.4%
Furnace fans and boiler circulation pumps.....	23	17	17	14	12	11	10	-2.0%
Other uses ⁴	230	213	216	201	194	198	202	-0.2%
Discrepancy ⁵	-3	0	0	0	0	0	0	-0.9%
Total residential.....	1,112	1,028	981	895	841	829	821	-0.9%
Commercial								
Space heating ⁶	139	125	124	117	112	109	107	-0.6%
Space cooling ⁶	78	85	75	67	61	60	60	-1.4%
Water heating ⁶	44	44	43	42	43	44	45	0.1%
Ventilation.....	82	77	76	69	63	62	62	-0.9%
Cooking.....	14	14	15	15	15	16	16	0.5%
Lighting.....	141	131	121	103	90	81	75	-2.2%
Refrigeration.....	58	54	46	38	33	32	32	-2.1%
Office equipment (PC).....	14	12	9	6	4	3	2	-6.3%
Office equipment (non-PC).....	34	33	33	32	34	37	39	0.7%
Other uses ⁷	362	343	352	349	352	372	389	0.5%
Total commercial.....	968	918	893	836	807	817	826	-0.4%
Industrial⁸								
Manufacturing								
Refining.....	261	257	247	238	233	235	241	-0.3%
Food products.....	99	94	97	96	97	100	104	0.4%
Paper products.....	79	72	65	65	64	61	60	-0.7%
Bulk chemicals.....	249	238	300	326	325	338	351	1.6%
Glass.....	15	16	17	17	17	17	17	0.1%
Cement and lime.....	24	24	30	32	32	34	38	1.8%
Iron and steel.....	115	108	94	106	105	104	107	0.0%
Aluminum.....	42	40	44	42	40	38	35	-0.5%
Fabricated metal products.....	33	33	31	29	27	28	29	-0.5%
Machinery.....	19	19	19	21	20	21	22	0.6%
Computers and electronics.....	19	18	18	17	17	18	19	0.3%
Transportation equipment.....	40	40	38	36	34	35	36	-0.4%
Electrical equipment.....	9	9	10	11	11	11	11	1.0%
Wood products.....	14	13	15	15	14	14	15	0.5%
Plastics.....	34	33	34	33	31	32	32	0.0%
Balance of manufacturing.....	137	131	127	122	117	116	116	-0.5%
Total manufacturing.....	1,190	1,144	1,186	1,205	1,186	1,202	1,233	0.3%
Nonmanufacturing								
Agriculture.....	86	85	82	79	76	74	72	-0.7%
Construction.....	69	64	83	83	81	82	82	1.0%
Mining.....	123	111	115	115	114	117	120	0.3%
Total nonmanufacturing.....	277	261	281	277	271	272	274	0.2%
Discrepancy ⁵	29	67	92	117	130	144	153	3.3%
Total industrial.....	1,497	1,472	1,558	1,600	1,587	1,618	1,660	0.5%

Table A19. Energy-related carbon dioxide emissions by end use (continued)
(million metric tons)

Sector and end use	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Transportation								
Light-duty vehicles.....	1,043	1,050	1,040	929	837	785	759	-1.3%
Commercial light trucks ⁹	54	54	55	53	51	51	52	-0.2%
Bus transportation.....	18	18	18	18	18	18	18	0.1%
Freight trucks.....	379	389	396	410	424	448	477	0.8%
Rail, passenger.....	6	5	5	5	5	5	5	0.0%
Rail, freight.....	34	34	34	36	35	33	33	-0.2%
Shipping, domestic.....	8	7	6	6	5	5	5	-1.5%
Shipping, international.....	49	55	48	50	52	54	56	0.1%
Recreational boats.....	16	17	18	19	19	20	20	0.7%
Air.....	166	168	178	189	200	207	212	0.9%
Military use.....	46	46	46	46	49	52	56	0.8%
Lubricants.....	5	5	5	5	5	5	5	0.2%
Pipeline fuel.....	46	47	44	47	50	53	57	0.7%
Discrepancy ⁵	-40	-40	-37	-30	-24	-20	-17	-3.4%
Total transportation.....	1,829	1,855	1,857	1,784	1,726	1,717	1,737	-0.3%
Biogenic energy combustion¹⁰								
Biomass.....	214	185	184	198	206	205	216	0.6%
Electric power sector.....	21	10	14	19	22	20	25	3.9%
Other sectors.....	193	175	169	178	184	185	191	0.3%
Biogenic waste.....	22	23	25	25	25	26	27	0.6%
Biofuels heat and coproducts.....	70	73	77	75	76	76	79	0.3%
Ethanol.....	76	79	79	75	74	76	82	0.2%
Biodiesel.....	14	16	22	14	14	14	14	-0.5%
Liquids from biomass.....	0	0	0	0	0	1	1	--
Renewable diesel and gasoline.....	0	0	6	14	14	14	14	17.9%
Total.....	396	376	393	401	409	413	432	0.6%

¹Does not include water heating portion of load.

²Includes televisions, set-top boxes, home theater systems, DVD players, and video game consoles.

³Includes desktop and laptop computers, monitors, and networking equipment.

⁴Includes small electric devices, heating elements, outdoor grills, exterior lights, pool heaters, spa heaters, backup electricity generators, and motors not listed above. Electric vehicles are included in the transportation sector.

⁵Represents differences between total emissions by end-use and total emissions by fuel as reported in Table A18. Emissions by fuel may reflect benchmarking and other modeling adjustments to energy use and the associated emissions that are not assigned to specific end uses.

⁶Includes emissions related to fuel consumption for district services.

⁷Includes emissions related to (but not limited to) miscellaneous uses such as transformers, medical imaging and other medical equipment, elevators, escalators, off-road electric vehicles, laboratory fume hoods, laundry equipment, coffee brewers, water services, emergency generators, combined heat and power in commercial buildings, manufacturing performed in commercial buildings, and cooking (distillate), plus residual fuel oil, propane, coal, motor gasoline, kerosene, and marketed renewable fuels (biomass).

⁸Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

⁹Commercial trucks 8,501 to 10,000 pounds gross vehicle weight rating.

¹⁰By convention, the direct emissions from biogenic energy sources are excluded from energy-related carbon dioxide emissions. The release of carbon from these sources is assumed to be balanced by the uptake of carbon when the feedstock is grown, resulting in zero net emissions over some period of time. If, however, increased use of biomass energy results in a decline in terrestrial carbon stocks, a net positive release of carbon may occur. Accordingly, the emissions from biogenic energy sources are reported here as an indication of the potential net release of carbon dioxide in the absence of offsetting sequestration.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 emissions and emission factors: U.S. Energy Information Administration (EIA), *Monthly Energy Review*, February 2016. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A20. Macroeconomic indicators
(billion 2009 chain-weighted dollars, unless otherwise noted)

Indicators	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Real gross domestic product	15,962	16,349	18,555	20,765	23,113	25,598	28,397	2.2%
Components of real gross domestic product								
Real consumption	10,876	11,221	12,861	14,348	16,092	17,881	19,870	2.3%
Real investment	2,718	2,842	3,513	4,068	4,520	5,051	5,661	2.8%
Real government spending	2,838	2,860	2,967	3,056	3,222	3,396	3,602	0.9%
Real exports	2,086	2,119	2,615	3,374	4,178	5,105	6,113	4.3%
Real imports	2,529	2,662	3,374	4,032	4,824	5,721	6,683	3.8%
Energy intensity (thousand Btu per 2009 dollar of GDP)								
Delivered energy	4.52	4.38	4.03	3.65	3.29	3.04	2.83	-1.7%
Total energy	6.15	5.92	5.42	4.89	4.39	4.06	3.77	-1.8%
Price indices								
GDP chain-type price index (2009=1.000)	1.09	1.10	1.21	1.34	1.49	1.66	1.85	2.1%
Consumer price index (1982-4=1.00)								
All-urban	2.37	2.37	2.65	2.99	3.35	3.78	4.27	2.4%
Energy commodities and services	2.43	2.02	2.41	2.87	3.34	3.92	4.61	3.4%
Wholesale price index (1982=1.00)								
All commodities	2.05	1.91	2.14	2.37	2.59	2.87	3.16	2.0%
Fuel and power	2.10	1.60	2.10	2.53	2.91	3.39	3.92	3.7%
Metals and metal products	2.15	2.01	2.15	2.35	2.55	2.80	3.06	1.7%
Industrial commodities excluding energy	1.98	1.94	2.13	2.33	2.53	2.76	3.01	1.8%
Interest rates (percent, nominal)								
Federal funds rate	0.09	0.13	3.32	3.22	3.24	3.23	3.08	--
10-year treasury note	2.54	2.14	3.83	3.66	3.77	3.82	3.72	--
AA utility bond rate	4.19	4.01	5.87	5.41	5.73	5.85	5.71	--
Value of shipments (billion 2009 dollars)								
Non-industrial and service sectors	23,338	24,085	26,750	29,265	32,042	34,833	37,701	1.8%
Total industrial	7,165	7,229	8,351	9,146	9,776	10,562	11,483	1.9%
Agriculture, mining, and construction	1,957	1,931	2,493	2,620	2,710	2,828	2,955	1.7%
Manufacturing	5,208	5,299	5,858	6,527	7,066	7,734	8,528	1.9%
Energy-intensive	1,718	1,704	1,892	2,046	2,147	2,267	2,417	1.4%
Non-energy-intensive	3,490	3,594	3,967	4,481	4,920	5,467	6,111	2.1%
Total shipments	30,504	31,314	35,101	38,411	41,818	45,396	49,184	1.8%
Population and employment (millions)								
Population, with armed forces overseas	319	322	335	348	360	371	381	0.7%
Population, aged 16 and over	254	257	269	281	292	302	311	0.8%
Population, aged 65 and over	46	48	57	66	74	79	82	2.2%
Employment, nonfarm	138	142	150	156	161	165	170	0.7%
Employment, manufacturing	12.2	12.5	13.1	13.4	13.0	12.6	12.3	-0.1%
Key labor indicators								
Labor force (millions)	156	157	167	171	177	183	188	0.7%
Nonfarm labor productivity (2009=1.00)	1.05	1.06	1.15	1.25	1.37	1.50	1.63	1.7%
Unemployment rate (percent)	6.15	5.31	4.72	4.90	4.78	4.76	4.78	--
Key indicators for energy demand								
Real disposable personal income	11,836	12,225	14,197	15,888	17,826	19,689	21,789	2.3%
Housing starts (millions)	1.06	1.18	1.74	1.71	1.66	1.66	1.65	1.3%
Commercial floorspace (billion square feet)	83.1	83.8	88.7	94.0	99.3	104.6	109.8	1.1%
Unit sales of light-duty vehicles (millions)	16.4	17.4	17.1	17.3	17.7	18.2	19.0	0.4%

GDP = Gross domestic product.

Btu = British thermal unit.

-- = Not applicable.

Sources: 2014 and 2015: IHS Economics, Industry and Employment models, November 2015. Projections: U.S. Energy Information Administration, AEO2016 National Energy Modeling System run ref2016.d032416a.

Table A21. International petroleum and other liquids supply, disposition, and prices
(million barrels per day, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Crude oil spot prices								
(2015 dollars per barrel)								
Brent.....	100	52	77	92	104	120	136	3.9%
West Texas Intermediate.....	94	49	71	85	97	112	129	4.0%
(nominal dollars per barrel)								
Brent.....	99	52	85	112	141	181	229	6.1%
West Texas Intermediate.....	93	49	79	105	131	170	217	6.2%
Petroleum and other liquids consumption¹								
OECD								
United States (50 states).....	19.16	19.42	20.11	19.90	19.54	19.69	20.14	0.1%
United States territories.....	0.30	0.30	0.31	0.32	0.34	0.36	0.38	1.0%
Canada.....	2.41	2.39	2.39	2.38	2.39	2.44	2.51	0.2%
Mexico and Chile.....	2.29	2.30	2.38	2.36	2.50	2.67	2.87	0.9%
OECD Europe ²	13.66	13.83	13.70	13.57	13.65	13.79	13.98	0.0%
Japan.....	4.30	4.14	3.91	3.75	3.66	3.56	3.40	-0.8%
South Korea.....	2.35	2.38	2.41	2.42	2.44	2.48	2.55	0.3%
Australia and New Zealand.....	1.24	1.28	1.35	1.39	1.41	1.45	1.53	0.7%
Total OECD consumption.....	45.71	46.03	46.56	46.08	45.93	46.44	47.35	0.1%
Non-OECD								
Russia.....	3.56	3.35	3.65	3.79	3.75	3.73	3.59	0.3%
Other Europe and Eurasia ³	2.04	2.07	2.18	2.34	2.43	2.48	2.53	0.8%
China.....	10.85	11.18	12.71	13.81	14.81	15.65	16.36	1.5%
India.....	3.78	3.97	4.54	5.19	5.94	6.97	8.26	3.0%
Other Asia ⁴	8.04	8.15	9.40	10.35	11.42	12.73	14.29	2.3%
Middle East.....	8.13	8.29	9.96	10.42	11.28	12.31	13.23	1.9%
Africa.....	3.71	3.86	4.54	5.06	5.50	6.08	6.93	2.4%
Brazil.....	3.15	3.15	3.41	3.74	4.06	4.39	4.71	1.6%
Other Central and South America.....	3.83	3.85	4.11	4.28	4.41	4.60	4.89	1.0%
Total non-OECD consumption.....	47.08	47.87	54.49	58.99	63.60	68.93	74.79	1.8%
Total consumption.....	92.79	93.90	101.05	105.06	109.52	115.37	122.14	1.1%
Petroleum and other liquids production								
OPEC ⁵								
Middle East.....	26.66	27.76	30.87	32.33	34.29	36.87	39.38	1.4%
North Africa.....	2.24	2.13	1.99	2.12	2.32	2.58	2.94	1.3%
West Africa.....	4.18	4.21	4.35	4.41	4.58	4.72	5.07	0.8%
South America.....	3.24	3.24	2.96	3.10	3.33	3.60	3.88	0.7%
Total OPEC production.....	36.33	37.33	40.17	41.96	44.52	47.75	51.28	1.3%
Non-OPEC								
OECD								
United States (50 states).....	14.01	14.95	16.33	16.52	17.26	17.93	18.62	0.9%
Canada.....	4.39	4.54	5.43	5.39	5.55	5.73	6.01	1.1%
Mexico and Chile.....	2.84	2.64	2.46	2.56	2.58	2.83	3.24	0.8%
OECD Europe ²	3.66	3.79	3.44	3.32	3.10	2.92	2.78	-1.2%
Japan and South Korea.....	0.22	0.22	0.20	0.21	0.21	0.22	0.22	0.0%
Australia and New Zealand.....	0.52	0.51	0.66	0.63	0.61	0.69	0.76	1.7%
Total OECD production.....	25.63	26.65	28.51	28.63	29.31	30.32	31.63	0.7%
Non-OECD								
Russia.....	10.85	10.95	10.62	10.99	11.22	11.51	12.21	0.4%
Other Europe and Eurasia ³	3.21	3.23	3.69	4.34	4.63	4.68	4.50	1.3%
China.....	4.60	4.69	4.90	5.23	5.44	5.91	6.24	1.1%
Other Asia ⁴	3.94	4.03	3.92	3.75	3.65	3.61	3.62	-0.4%
Middle East.....	1.17	1.14	1.02	0.91	0.83	0.76	0.69	-2.0%
Africa.....	2.33	2.33	2.48	2.58	2.73	2.79	2.83	0.8%
Brazil.....	2.97	3.15	3.59	4.59	5.00	5.46	6.15	2.7%
Other Central and South America.....	2.18	2.18	2.15	2.10	2.19	2.58	2.99	1.3%
Total non-OECD production.....	31.25	31.70	32.37	34.48	35.69	37.30	39.23	0.9%
Total petroleum and other liquids production	93.21	95.68	101.05	105.06	109.52	115.37	122.14	1.0%
OPEC market share (percent).....	39.0	39.0	39.8	39.9	40.7	41.4	42.0	--

Table A21. International petroleum and other liquids supply, disposition, and prices (continued)
(million barrels per day, unless otherwise noted)

Supply, disposition, and prices	Reference case							Annual growth 2015-2040 (percent)
	2014	2015	2020	2025	2030	2035	2040	
Selected world production subtotals:								
Crude oil and equivalents ⁶	77.98	80.13	82.77	85.71	89.12	93.95	99.74	0.9%
Tight oil	4.69	5.34	5.44	5.85	6.96	8.50	10.35	2.7%
Bitumen ⁷	2.25	2.32	3.08	3.12	3.18	3.24	3.31	1.4%
Refinery processing gain ⁸	2.50	2.45	2.53	2.62	2.73	2.84	2.94	0.7%
Natural gas plant liquids	10.07	10.37	12.32	12.88	13.24	13.58	13.88	1.2%
Liquids from renewable sources ⁹	2.26	2.32	2.54	2.88	3.31	3.71	4.11	2.3%
Liquids from coal ¹⁰	0.20	0.25	0.27	0.16	0.26	0.36	0.50	2.8%
Liquids from natural gas ¹¹	0.27	0.29	0.32	0.52	0.57	0.62	0.65	3.3%
Liquids from kerogen ¹²	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.7%
Crude oil production⁶								
OPEC ⁵								
Middle East	23.32	24.38	27.07	28.31	30.10	32.42	34.74	1.4%
North Africa	1.89	1.78	1.61	1.71	1.82	1.97	2.20	0.9%
West Africa	4.16	4.19	4.28	4.34	4.51	4.64	4.99	0.7%
South America	3.06	3.05	2.75	2.85	3.09	3.35	3.64	0.7%
Total OPEC production	32.43	33.40	35.72	37.22	39.52	42.38	45.57	1.3%
Non-OPEC								
OECD								
United States (50 states)	8.71	9.42	9.38	9.43	10.06	10.66	11.26	0.7%
Canada	3.61	3.72	4.57	4.42	4.53	4.69	4.96	1.2%
Mexico and Chile	2.48	2.31	2.16	2.27	2.29	2.55	2.96	1.0%
OECD Europe ²	2.82	2.95	2.31	2.15	1.88	1.65	1.47	-2.7%
Japan and South Korea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.2%
Australia and New Zealand	0.39	0.39	0.53	0.51	0.49	0.56	0.64	1.9%
Total OECD production	18.01	18.81	18.96	18.78	19.24	20.12	21.29	0.5%
Non-OECD								
Russia	10.11	10.17	9.84	10.23	10.49	10.81	11.53	0.5%
Other Europe and Eurasia ³	2.99	3.00	3.43	4.07	4.36	4.40	4.23	1.4%
China	4.20	4.28	4.34	4.46	4.40	4.63	4.67	0.3%
Other Asia ⁴	3.10	3.18	2.98	2.73	2.52	2.38	2.25	-1.4%
Middle East	1.14	1.11	1.00	0.89	0.81	0.74	0.67	-2.0%
Africa	1.94	1.94	2.01	2.10	2.25	2.30	2.34	0.8%
Brazil	2.25	2.43	2.77	3.58	3.78	4.07	4.67	2.7%
Other Central and South America	1.80	1.81	1.72	1.65	1.75	2.12	2.52	1.3%
Total non-OECD production	27.54	27.92	28.09	29.72	30.36	31.45	32.87	0.7%
Total crude oil production⁶	77.98	80.13	82.77	85.71	89.12	93.95	99.74	0.9%
OPEC market share (percent)	41.6	41.7	43.2	43.4	44.3	45.1	45.7	--

¹Estimated consumption. Includes both OPEC and non-OPEC consumers in the regional breakdown.

²OECD Europe = Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

³Other Europe and Eurasia = Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kosovo, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malta, Moldova, Montenegro, Romania, Serbia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

⁴Other Asia = Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia (Kampuchea), Fiji, French Polynesia, Guam, Hong Kong, India (for production), Indonesia, Kiribati, Laos, Malaysia, Macau, Maldives, Mongolia, Myanmar (Burma), Nauru, Nepal, New Caledonia, Niue, North Korea, Pakistan, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Tonga, Vanuatu, and Vietnam.

⁵OPEC = Organization of the Petroleum Exporting Countries = Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

⁶Includes crude oil, lease condensate, tight oil (shale oil), extra-heavy oil, and bitumen (oil sands).

⁷Includes diluted and upgraded/synthetic bitumen (syncrude).

⁸The volumetric amount by which total output is greater than input due to the processing of crude oil into products which, in total, have a lower specific gravity than the crude oil processed.

⁹Includes liquids produced from energy crops.

¹⁰Includes liquids converted from coal via the Fischer-Tropsch coal-to-liquids process.

¹¹Includes liquids converted from natural gas via the Fischer-Tropsch gas-to-liquids process.

¹²Includes liquids produced from kerogen (oil shale, not to be confused with tight oil (shale oil)).

OECD = Organization for Economic Cooperation and Development.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2014 are model results and may differ from official EIA data reports.

Sources: 2014 Brent and West Texas Intermediate crude oil spot prices: Thomson Reuters. 2015: EIA, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System run ref2016.d032416a and EIA, Generate World Oil Balance application.

Appendix B

Economic growth case comparisons

Table B1. Total energy supply, disposition, and price summary
(quadrillion Btu per year, unless otherwise noted)

Supply, disposition, and prices	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Production										
Crude oil and lease condensate.....	19.7	19.5	19.6	19.6	20.8	21.0	21.2	23.3	23.5	23.8
Natural gas plant liquids.....	4.4	6.0	6.1	6.2	6.4	6.5	6.5	6.5	6.7	6.7
Dry natural gas.....	28.0	30.9	31.4	31.7	37.9	38.9	38.8	42.5	43.4	44.0
Coal ¹	17.2	16.6	17.5	18.5	13.6	13.3	13.7	13.3	13.1	13.8
Nuclear / uranium ²	8.3	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2
Conventional hydroelectric power.....	2.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9
Biomass ³	4.1	4.2	4.2	4.4	4.3	4.4	4.7	4.1	4.6	5.4
Other renewable energy ⁴	2.6	4.9	4.6	4.9	5.6	6.6	9.6	6.4	8.8	13.3
Other ⁵	0.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.1
Total.....	87.3	93.9	95.4	97.0	100.4	102.7	106.5	107.9	112.2	119.1
Imports										
Crude oil.....	16.1	16.0	16.8	17.7	14.0	16.0	18.0	12.5	15.9	18.5
Petroleum and other liquids ⁶	3.9	4.5	4.5	4.6	4.2	4.3	4.4	4.1	4.3	4.7
Natural gas ⁷	2.8	2.1	2.1	2.2	1.5	1.6	1.6	1.4	1.4	1.5
Other imports ⁸	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2
Total.....	23.2	22.7	23.6	24.7	19.8	22.0	24.2	18.1	21.8	24.9
Exports										
Petroleum and other liquids ⁹	9.0	11.7	11.6	11.6	13.4	13.5	13.5	15.1	15.2	15.2
Natural gas ¹⁰	1.8	5.0	5.0	5.0	8.1	7.6	7.2	9.7	9.0	8.3
Coal.....	2.0	1.9	1.9	1.9	1.9	1.9	1.8	2.3	2.3	2.3
Total.....	12.8	18.5	18.5	18.4	23.4	23.0	22.5	27.1	26.6	25.8
Discrepancy¹¹.....	1.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.3
Consumption										
Petroleum and other liquids ¹²	36.5	36.8	37.8	39.0	34.2	36.6	39.0	33.5	37.5	41.1
Natural gas.....	28.3	27.7	28.3	28.6	31.0	32.5	32.8	33.7	35.4	36.8
Coal ¹³	15.5	14.6	15.6	16.5	11.7	11.3	11.9	10.9	10.7	11.4
Nuclear / uranium ²	8.3	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2
Conventional hydroelectric power.....	2.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9
Biomass ¹⁴	2.8	2.7	2.8	2.9	2.8	3.0	3.3	2.8	3.1	3.8
Other renewable energy ⁴	2.6	4.9	4.6	4.9	5.6	6.6	9.6	6.4	8.8	13.3
Other ¹⁵	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total.....	96.7	98.1	100.5	103.3	96.7	101.5	108.0	98.7	107.1	117.9
Prices (2015 dollars per unit)										
Crude oil spot prices (dollars per barrel)										
Brent.....	52	76	77	77	102	104	106	133	136	139
West Texas Intermediate.....	49	70	71	72	96	97	99	125	129	132
Natural gas at Henry Hub (dollars per million Btu).....										
Coal (dollars per ton).....	2.62	4.24	4.43	4.58	4.70	5.06	4.96	4.54	4.86	5.04
at the minemouth ¹⁶	33.8	33.9	33.6	33.9	34.1	33.8	34.0	39.7	38.7	40.0
Coal (dollars per million Btu).....	1.69	1.70	1.68	1.69	1.73	1.71	1.71	1.95	1.91	1.96
at the minemouth ¹⁶	2.37	2.42	2.43	2.48	2.58	2.55	2.62	2.70	2.68	2.79
Average end-use ¹⁷	10.3	10.7	10.5	10.5	10.9	10.9	10.8	10.5	10.5	10.5
Average electricity (cents per kilowatthour).....										

Table B1. Total energy supply, disposition, and price summary (continued)
(quadrillion Btu per year, unless otherwise noted)

Supply, disposition, and prices	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Prices (nominal dollars per unit)										
Crude oil spot prices (dollars per barrel)										
Brent.....	52	86	85	84	160	141	140	294	229	230
West Texas Intermediate	49	80	79	78	150	131	131	276	217	218
Natural gas at Henry Hub (dollars per million Btu)	2.62	4.82	4.90	4.99	7.36	6.84	6.58	10.00	8.17	8.32
Coal (dollars per ton) at the minemouth ¹⁶	33.8	38.5	37.1	37.0	53.4	45.8	45.0	87.4	65.1	66.1
Coal (dollars per million Btu) at the minemouth ¹⁶	1.69	1.93	1.86	1.85	2.70	2.31	2.27	4.30	3.21	3.24
Average end-use ¹⁷	2.37	2.75	2.69	2.70	4.04	3.45	3.47	5.95	4.50	4.62
Average electricity (cents per kilowatthour)...	10.3	12.1	11.6	11.5	17.1	14.7	14.3	23.2	17.6	17.3

¹Includes waste coal.

²These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

³Includes grid-connected electricity from wood and wood waste; biomass, such as corn, used for liquid fuels production; and non-electric energy demand from wood. Refer to Table A17 for details.

⁴Includes grid-connected electricity from landfill gas; biogenic municipal waste; wind; photovoltaic and solar thermal sources; and non-electric energy from renewable sources, such as active and passive solar systems. Excludes electricity imports using renewable sources and nonmarketed renewable energy. See Table A17 for selected nonmarketed residential and commercial renewable energy data.

⁵Includes non-biogenic municipal waste, liquid hydrogen, methanol, and some domestic inputs to refineries.

⁶Includes imports of finished petroleum products, unfinished oils, alcohols, ethers, blending components, and renewable fuels such as ethanol.

⁷Includes imports of liquefied natural gas that are later re-exported.

⁸Includes coal, coal coke (net), and electricity (net). Excludes imports of fuel used in nuclear power plants.

⁹Includes crude oil, petroleum products, ethanol, and biodiesel.

¹⁰Includes re-exported liquefied natural gas.

¹¹Balancing item. Includes unaccounted for supply, losses, gains, and net storage withdrawals.

¹²Estimated consumption. Includes petroleum-derived fuels and non-petroleum derived fuels, such as ethanol and biodiesel, and coal-based synthetic liquids. Petroleum coke, which is a solid, is included. Also included are hydrocarbon gas liquids and crude oil consumed as a fuel. Refer to Table A17 for detailed renewable liquid fuels consumption.

¹³Excludes coal converted to coal-based synthetic liquids and natural gas.

¹⁴Includes grid-connected electricity from wood and wood waste, non-electric energy from wood, and biofuels heat and coproducts used in the production of liquid fuels, but excludes the energy content of the liquid fuels.

¹⁵Includes non-biogenic municipal waste, liquid hydrogen, and net electricity imports.

¹⁶Includes reported prices for both open market and captive mines. Prices weighted by production, which differs from average minemouth prices published in EIA data reports where it is weighted by reported sales.

¹⁷Prices weighted by consumption; weighted average excludes export free-alongside-ship (f.a.s.) prices.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowmacro.d032516a, ref2016.d032416a, and highmacro.d032516a.

Table B2. Energy consumption by sector and source
(quadrillion Btu per year, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Energy consumption										
Residential										
Propane	0.43	0.42	0.42	0.43	0.37	0.38	0.39	0.32	0.34	0.36
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Distillate fuel oil	0.50	0.43	0.43	0.43	0.34	0.34	0.34	0.27	0.27	0.27
Petroleum and other liquids subtotal.....	0.93	0.86	0.86	0.87	0.71	0.72	0.73	0.59	0.61	0.64
Natural gas	4.77	4.80	4.87	4.92	4.57	4.80	5.08	4.30	4.73	5.20
Renewable energy ¹	0.44	0.41	0.42	0.42	0.38	0.39	0.40	0.35	0.37	0.38
Electricity	4.78	4.64	4.76	4.85	4.53	4.83	5.21	4.66	5.20	5.90
Delivered energy	10.92	10.72	10.90	11.05	10.18	10.74	11.42	9.91	10.91	12.12
Electricity related losses	9.44	9.14	9.37	9.56	8.44	8.77	9.50	8.38	9.15	10.44
Total	20.37	19.85	20.27	20.62	18.62	19.50	20.92	18.28	20.05	22.56
Commercial										
Propane	0.17	0.18	0.18	0.18	0.19	0.19	0.20	0.19	0.20	0.21
Motor gasoline ²	0.04	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07
Kerosene	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Distillate fuel oil	0.37	0.36	0.36	0.36	0.32	0.32	0.32	0.29	0.29	0.29
Residual fuel oil.....	0.07	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10
Petroleum and other liquids subtotal.....	0.66	0.70	0.70	0.71	0.67	0.68	0.69	0.65	0.67	0.68
Natural gas	3.32	3.45	3.45	3.45	3.51	3.53	3.60	3.77	3.81	3.87
Coal	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Renewable energy ³	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Electricity	4.64	4.65	4.69	4.71	4.96	5.09	5.19	5.41	5.62	5.80
Delivered energy	8.81	8.99	9.03	9.05	9.34	9.49	9.67	10.02	10.28	10.54
Electricity related losses	9.16	9.15	9.23	9.29	9.24	9.23	9.47	9.72	9.89	10.28
Total	17.97	18.14	18.26	18.34	18.58	18.72	19.13	19.74	20.17	20.82
Industrial⁴										
Liquefied petroleum gases and other ⁵	2.38	3.00	3.10	3.21	3.46	3.66	3.80	3.96	4.22	4.22
Motor gasoline ²	0.27	0.27	0.28	0.28	0.26	0.27	0.28	0.26	0.27	0.29
Distillate fuel oil	1.34	1.36	1.44	1.51	1.33	1.44	1.53	1.35	1.47	1.60
Residual fuel oil.....	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.05	0.05	0.06
Petrochemical feedstocks.....	0.66	0.94	0.96	1.00	1.24	1.31	1.36	1.55	1.66	1.64
Other petroleum ⁶	3.38	3.39	3.59	3.78	3.45	3.82	4.15	3.59	4.15	4.63
Petroleum and other liquids subtotal.....	8.07	9.00	9.40	9.82	9.80	10.55	11.19	10.75	11.82	12.45
Natural gas	7.75	8.35	8.55	8.84	8.67	9.13	9.78	9.16	9.89	10.93
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lease and plant fuel ⁷	1.63	1.73	1.76	1.77	2.02	2.06	2.06	2.26	2.31	2.33
Natural gas liquefaction for export ⁸	0.00	0.26	0.26	0.26	0.57	0.53	0.49	0.75	0.69	0.62
Natural gas subtotal.....	9.38	10.34	10.57	10.87	11.25	11.72	12.33	12.16	12.89	13.89
Metallurgical coal	0.54	0.39	0.41	0.52	0.47	0.47	0.60	0.37	0.40	0.59
Other industrial coal	0.82	0.79	0.82	0.87	0.81	0.88	1.00	0.82	0.93	1.16
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net coal coke imports	-0.02	-0.03	-0.01	-0.03	-0.02	0.00	-0.01	0.00	0.01	0.02
Coal subtotal.....	1.34	1.16	1.23	1.36	1.26	1.35	1.59	1.19	1.34	1.78
Biofuels heat and coproducts.....	0.78	0.81	0.83	0.83	0.81	0.81	0.82	0.74	0.84	0.90
Renewable energy ⁹	1.48	1.40	1.48	1.58	1.49	1.67	1.94	1.53	1.79	2.34
Electricity	3.27	3.45	3.61	3.82	3.69	3.98	4.36	3.86	4.26	4.90
Delivered energy	24.33	26.16	27.11	28.28	28.31	30.07	32.25	30.23	32.94	36.26
Electricity related losses	6.46	6.79	7.11	7.52	6.88	7.22	7.96	6.94	7.50	8.69
Total	30.79	32.95	34.22	35.80	35.19	37.29	40.21	37.17	40.44	44.95

Table B2. Energy consumption by sector and source (continued)
(quadrillion Btu per year, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Transportation										
Propane	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03
Motor gasoline ²	17.01	16.52	16.79	17.05	12.65	13.62	14.35	10.57	12.55	13.77
of which: E85 ¹⁰	0.05	0.04	0.04	0.04	0.33	0.22	0.19	0.36	0.28	0.30
Jet fuel ¹¹	2.84	2.92	2.99	3.06	3.18	3.32	3.49	3.40	3.56	3.74
Distillate fuel oil ¹²	6.67	6.66	6.99	7.38	6.93	7.49	8.28	7.21	8.01	9.54
Residual fuel oil	0.45	0.36	0.37	0.38	0.40	0.42	0.43	0.42	0.45	0.49
Other petroleum ¹³	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.16	0.17
Petroleum and other liquids subtotal	27.14	26.64	27.32	28.04	23.33	25.01	26.72	21.76	24.75	27.73
Pipeline fuel natural gas	0.89	0.82	0.83	0.84	0.91	0.94	0.95	1.04	1.07	1.10
Compressed / liquefied natural gas	0.07	0.08	0.08	0.09	0.16	0.17	0.18	0.57	0.59	0.73
Liquid hydrogen	0.00	0.01	0.01	0.01	0.04	0.04	0.05	0.05	0.06	0.07
Electricity	0.03	0.05	0.05	0.05	0.10	0.11	0.12	0.13	0.15	0.17
Delivered energy	28.13	27.59	28.29	29.02	24.54	26.28	28.01	23.56	26.63	29.79
Electricity related losses	0.06	0.09	0.09	0.09	0.19	0.20	0.21	0.24	0.27	0.29
Total	28.19	27.68	28.38	29.11	24.74	26.48	28.23	23.80	26.90	30.08
Unspecified sector¹⁴	-0.58	-0.57	-0.58	-0.60	-0.41	-0.46	-0.50	-0.33	-0.42	-0.50
Delivered energy consumption for all sectors										
Liquefied petroleum gases and other ⁵	2.99	3.61	3.71	3.83	4.03	4.24	4.40	4.49	4.79	4.82
Motor gasoline ²	16.96	16.28	16.55	16.80	12.55	13.49	14.21	10.54	12.47	13.66
of which: E85 ¹⁰	0.05	0.04	0.04	0.04	0.33	0.22	0.19	0.36	0.28	0.30
Jet fuel ¹¹	3.18	3.15	3.22	3.30	3.43	3.58	3.76	3.66	3.83	4.03
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Distillate fuel oil	8.33	8.59	8.98	9.44	8.68	9.33	10.20	8.87	9.77	11.39
Residual fuel oil	0.56	0.51	0.52	0.53	0.55	0.57	0.59	0.56	0.60	0.65
Petrochemical feedstocks	0.66	0.94	0.96	1.00	1.24	1.31	1.36	1.55	1.66	1.64
Other petroleum ¹⁵	3.54	3.55	3.75	3.94	3.61	3.98	4.32	3.74	4.31	4.80
Petroleum and other liquids subtotal	36.23	36.63	37.70	38.84	34.10	36.51	38.84	33.43	37.44	41.00
Natural gas	15.90	16.68	16.95	17.29	16.91	17.63	18.64	17.79	19.02	20.73
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lease and plant fuel ⁷	1.63	1.73	1.76	1.77	2.02	2.06	2.06	2.26	2.31	2.33
Pipeline natural gas	0.00	0.26	0.26	0.26	0.57	0.53	0.49	0.75	0.69	0.62
Natural gas liquefaction for export ⁸	0.89	0.82	0.83	0.84	0.91	0.94	0.95	1.04	1.07	1.10
Natural gas subtotal	18.43	19.49	19.80	20.16	20.41	21.16	22.13	21.84	23.09	24.79
Metallurgical coal	0.54	0.39	0.41	0.52	0.47	0.47	0.60	0.37	0.40	0.59
Other coal	0.88	0.84	0.88	0.93	0.86	0.93	1.05	0.88	0.98	1.22
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net coal coke imports	-0.02	-0.03	-0.01	-0.03	-0.02	0.00	-0.01	0.00	0.01	0.02
Coal subtotal	1.40	1.21	1.28	1.42	1.32	1.40	1.65	1.24	1.39	1.83
Biofuels heat and coproducts	0.78	0.81	0.83	0.83	0.81	0.81	0.82	0.74	0.84	0.90
Renewable energy ¹⁶	2.06	1.95	2.03	2.13	2.01	2.19	2.48	2.01	2.29	2.86
Liquid hydrogen	0.00	0.01	0.01	0.01	0.04	0.04	0.05	0.05	0.06	0.07
Electricity	12.72	12.78	13.11	13.42	13.28	14.01	14.88	14.07	15.23	16.77
Delivered energy	71.62	72.89	74.75	76.81	71.96	76.12	80.85	73.38	80.34	88.21
Electricity related losses	25.12	25.17	25.80	26.46	24.76	25.41	27.14	25.28	26.81	29.70
Total	96.74	98.06	100.55	103.27	96.72	101.54	107.99	98.66	107.15	117.91
Electric power¹⁷										
Distillate fuel oil	0.09	0.08	0.09	0.09	0.07	0.06	0.07	0.06	0.05	0.06
Residual fuel oil	0.17	0.06	0.06	0.06	0.04	0.04	0.05	0.03	0.03	0.03
Petroleum and other liquids subtotal	0.26	0.14	0.15	0.15	0.11	0.11	0.11	0.09	0.09	0.09
Natural gas	9.89	8.18	8.50	8.44	10.56	11.34	10.70	11.85	12.31	12.01
Steam coal	14.08	13.42	14.34	15.13	10.33	9.92	10.22	9.64	9.36	9.56
Nuclear / uranium ¹⁸	8.34	8.12	8.12	8.12	8.25	8.25	8.25	8.25	8.25	8.25
Renewable energy ¹⁹	4.86	7.67	7.37	7.62	8.40	9.41	12.34	9.15	11.67	16.18
Non-biogenic municipal waste	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Electricity imports	0.19	0.19	0.19	0.20	0.17	0.17	0.17	0.15	0.15	0.15
Total	37.85	37.95	38.90	39.89	38.04	39.42	42.02	39.35	42.04	46.47

Table B2. Energy consumption by sector and source (continued)
(quadrillion Btu per year, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Total energy consumption										
Liquefied petroleum gases and other ⁵	2.99	3.61	3.71	3.83	4.03	4.24	4.40	4.49	4.79	4.82
Motor gasoline ²	16.96	16.28	16.55	16.80	12.55	13.49	14.21	10.54	12.47	13.66
of which: E85 ¹⁰	0.05	0.04	0.04	0.04	0.33	0.22	0.19	0.36	0.28	0.30
Jet fuel ¹¹	3.18	3.15	3.22	3.30	3.43	3.58	3.76	3.66	3.83	4.03
Kerosene.....	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Distillate fuel oil.....	8.42	8.67	9.07	9.53	8.75	9.40	10.26	8.93	9.82	11.44
Residual fuel oil.....	0.73	0.57	0.58	0.59	0.59	0.62	0.64	0.59	0.64	0.68
Petrochemical feedstocks.....	0.66	0.94	0.96	1.00	1.24	1.31	1.36	1.55	1.66	1.64
Other petroleum ¹⁵	3.54	3.55	3.75	3.94	3.61	3.98	4.32	3.74	4.31	4.80
Petroleum and other liquids subtotal.....	36.49	36.77	37.85	38.99	34.21	36.62	38.96	33.51	37.52	41.09
Natural gas.....	25.79	24.87	25.45	25.73	27.47	28.97	29.33	29.64	31.33	32.74
Natural-gas-to-liquids heat and power.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lease and plant fuel ⁷	1.63	1.73	1.76	1.77	2.02	2.06	2.06	2.26	2.31	2.33
Natural gas liquefaction for export ⁸	0.00	0.26	0.26	0.26	0.57	0.53	0.49	0.75	0.69	0.62
Pipeline natural gas.....	0.89	0.82	0.83	0.84	0.91	0.94	0.95	1.04	1.07	1.10
Natural gas subtotal.....	28.31	27.67	28.30	28.60	30.96	32.51	32.83	33.69	35.39	36.80
Metallurgical coal.....	0.54	0.39	0.41	0.52	0.47	0.47	0.60	0.37	0.40	0.59
Other coal.....	14.96	14.26	15.22	16.06	11.20	10.86	11.28	10.52	10.34	10.78
Coal-to-liquids heat and power.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net coal coke imports.....	-0.02	-0.03	-0.01	-0.03	-0.02	0.00	-0.01	0.00	0.01	0.02
Coal subtotal.....	15.48	14.63	15.62	16.54	11.65	11.32	11.87	10.89	10.75	11.39
Nuclear / uranium ¹⁸	8.34	8.12	8.12	8.12	8.25	8.25	8.25	8.25	8.25	8.25
Biofuels heat and coproducts.....	0.78	0.81	0.83	0.83	0.81	0.81	0.82	0.74	0.84	0.90
Renewable energy ²⁰	6.92	9.62	9.40	9.75	10.41	11.60	14.82	11.17	13.96	19.05
Liquid hydrogen.....	0.00	0.01	0.01	0.01	0.04	0.04	0.05	0.05	0.06	0.07
Non-biogenic municipal waste.....	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Electricity imports.....	0.19	0.19	0.19	0.20	0.17	0.17	0.17	0.15	0.15	0.15
Total.....	96.74	98.06	100.55	103.27	96.72	101.54	107.99	98.66	107.15	117.91
Energy use and related statistics										
Delivered energy use.....	71.62	72.89	74.75	76.81	71.96	76.12	80.85	73.38	80.34	88.21
Total energy use.....	96.74	98.06	100.55	103.27	96.72	101.54	107.99	98.66	107.15	117.91
Ethanol consumed in motor gasoline and E85.....	1.18	1.17	1.19	1.20	1.12	1.12	1.16	1.12	1.24	1.35
Population (millions).....	322	334	335	336	355	360	364	371	381	391
Gross domestic product (billion 2009 dollars)....	16,349	17,576	18,555	19,499	20,749	23,113	25,606	24,511	28,397	32,967
Carbon dioxide emissions (million metric tons).....	5,273	5,098	5,289	5,458	4,762	4,961	5,176	4,720	5,044	5,417

¹Includes wood used for residential heating. See Table A4 and/or Table A17 for estimates of nonmarketed renewable energy consumption for geothermal heat pumps, solar thermal water heating, and electricity generation from wind and solar photovoltaic sources.

²Includes ethanol and ethers blended into gasoline.

³Excludes ethanol. Includes commercial sector consumption of wood and wood waste, landfill gas, municipal waste, and other biomass for combined heat and power.

See Table A5 and/or Table A17 for estimates of nonmarketed renewable energy consumption for solar thermal water heating and electricity generation from wind and solar photovoltaic sources.

⁴Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

⁵Includes ethane, natural gasoline, and refinery olefins.

⁶Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

⁷Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.

⁸Fuel used in facilities that liquefy natural gas for export.

⁹Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources. Excludes ethanol in motor gasoline.

¹⁰E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

¹¹Includes only kerosene type.

¹²Diesel fuel for on- and off- road use.

¹³Includes aviation gasoline and lubricants.

¹⁴Represents consumption unattributed to the sectors above.

¹⁵Includes aviation gasoline, petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

¹⁶Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes ethanol and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

¹⁷Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

¹⁸These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

¹⁹Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources.

Excludes net electricity imports.

²⁰Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources.

Excludes ethanol, net electricity imports, and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

Btu = British thermal unit.

Note: Includes estimated consumption for petroleum and other liquids. Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowmacro.d032516a, ref2016.d032416a, and highmacro.d032516a.

Table B3. Energy prices by sector and source
(2015 dollars per million Btu, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Residential										
Propane	16.9	20.1	20.2	20.3	22.2	22.4	22.6	25.5	25.6	26.1
Distillate fuel oil	19.3	22.2	22.4	22.6	27.3	27.8	28.3	33.0	33.8	34.6
Natural gas.....	10.1	10.5	10.7	11.0	11.5	12.0	12.2	11.7	12.3	13.0
Electricity.....	36.3	38.5	37.7	37.7	40.0	39.4	39.0	38.9	38.1	37.8
Commercial										
Propane	15.1	17.9	17.9	18.0	19.7	19.8	20.0	22.5	22.5	23.0
Distillate fuel oil	17.0	19.5	19.7	19.9	24.1	24.4	24.9	29.8	30.5	31.3
Residual fuel oil.....	6.9	10.8	11.0	11.1	15.0	15.3	15.6	19.4	19.9	20.4
Natural gas.....	7.7	9.1	9.3	9.5	10.0	10.4	10.4	9.9	10.4	10.8
Electricity.....	30.6	31.7	31.5	31.7	32.3	32.3	32.4	30.8	30.7	31.1
Industrial¹										
Propane	12.2	15.5	15.6	15.7	17.7	17.8	18.1	21.1	21.1	21.7
Distillate fuel oil	17.0	19.5	19.7	19.9	24.2	24.4	24.9	29.9	30.5	31.3
Residual fuel oil.....	6.8	11.1	11.3	11.4	15.7	15.9	16.2	20.0	20.6	21.1
Natural gas ²	3.7	5.2	5.4	5.5	5.6	6.0	5.9	5.4	5.7	5.9
Metallurgical coal	5.4	6.0	6.0	6.1	7.0	7.0	7.0	7.2	7.3	7.3
Other industrial coal	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.6	3.6	3.7
Coal to liquids	--	--	--	--	--	--	--	--	--	--
Electricity.....	20.3	21.0	20.9	21.0	21.7	22.1	22.1	21.0	21.2	21.6
Transportation										
Propane	18.0	21.2	21.2	21.4	23.3	23.4	23.7	26.6	26.6	27.2
E85 ³	23.3	31.7	32.0	31.6	27.4	30.8	31.7	30.1	35.0	36.0
Motor gasoline ⁴	20.9	22.5	22.7	22.8	26.1	26.5	26.9	30.4	31.8	32.6
Jet fuel ⁵	12.0	16.0	16.2	16.4	20.9	21.3	21.9	27.2	27.7	28.4
Diesel fuel (distillate fuel oil) ⁶	19.8	22.9	23.1	23.3	27.8	28.0	28.5	33.4	34.1	34.8
Residual fuel oil.....	8.1	11.5	11.7	11.8	14.8	15.0	15.3	18.8	19.2	19.7
Natural gas ⁷	16.6	16.4	16.6	16.9	15.0	15.5	15.6	15.3	15.9	16.3
Electricity.....	29.5	33.3	33.0	33.2	37.1	37.4	37.0	35.4	35.5	35.6
Electric power⁸										
Distillate fuel oil	15.0	18.2	18.4	18.7	23.0	23.5	24.0	28.6	29.4	30.2
Residual fuel oil.....	10.2	13.6	13.8	13.9	17.8	18.1	18.4	21.8	22.4	23.0
Natural gas.....	3.3	4.5	4.7	4.8	5.2	5.6	5.4	5.1	5.4	5.5
Steam coal.....	2.2	2.2	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4
Average price to all users⁹										
Propane	14.9	18.0	18.0	18.1	20.0	20.1	20.3	23.1	23.2	23.7
E85 ³	23.3	31.7	32.0	31.6	27.4	30.8	31.7	30.1	35.0	36.0
Motor gasoline ⁴	20.9	22.5	22.7	22.8	26.1	26.5	26.9	30.4	31.8	32.6
Jet fuel ⁵	12.0	16.0	16.2	16.4	20.9	21.3	21.9	27.2	27.7	28.4
Distillate fuel oil	19.1	22.1	22.3	22.5	27.1	27.3	27.8	32.8	33.3	34.2
Residual fuel oil.....	8.4	11.6	11.7	11.8	15.1	15.4	15.7	19.1	19.6	20.1
Natural gas.....	5.3	6.6	6.7	6.9	7.1	7.4	7.4	7.0	7.4	7.7
Metallurgical coal	5.4	6.0	6.0	6.1	7.0	7.0	7.0	7.2	7.3	7.3
Other coal	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.5	2.5	2.6
Coal to liquids	--	--	--	--	--	--	--	--	--	--
Electricity.....	30.1	31.3	30.8	30.8	32.0	31.9	31.7	30.8	30.6	30.7
Non-renewable energy expenditures by sector (billion 2015 dollars)										
Residential	239	247	250	256	251	266	284	249	274	309
Commercial.....	178	192	193	195	210	216	221	221	230	241
Industrial ¹	168	220	232	247	275	301	325	332	369	411
Transportation.....	514	566	586	605	585	640	697	660	777	894
Total non-renewable expenditures.....	1,099	1,225	1,260	1,302	1,321	1,423	1,526	1,462	1,650	1,855
Transportation renewable expenditures.....	1	1	1	1	9	7	6	11	10	11
Total expenditures	1,100	1,226	1,262	1,303	1,330	1,430	1,532	1,472	1,660	1,866

Table B3. Energy prices by sector and source (continued)
(nominal dollars per million Btu, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Residential										
Propane	16.9	22.8	22.3	22.2	34.8	30.3	30.0	56.3	43.0	43.1
Distillate fuel oil	19.3	25.2	24.7	24.7	42.6	37.6	37.4	72.8	56.9	57.2
Natural gas.....	10.1	12.0	11.9	12.0	18.0	16.3	16.1	25.7	20.8	21.4
Electricity.....	36.3	43.7	41.7	41.1	62.5	53.3	51.7	85.8	64.2	62.4
Commercial										
Propane	15.1	20.3	19.8	19.7	30.8	26.8	26.5	49.6	37.9	38.0
Distillate fuel oil	17.0	22.1	21.8	21.7	37.7	33.1	33.0	65.6	51.2	51.6
Residual fuel oil.....	6.9	12.3	12.1	12.1	23.5	20.7	20.7	42.7	33.6	33.7
Natural gas.....	7.7	10.4	10.3	10.4	15.6	14.1	13.8	21.9	17.5	17.8
Electricity.....	30.6	36.0	34.8	34.5	50.5	43.7	42.9	67.8	51.7	51.4
Industrial¹										
Propane	12.2	17.6	17.2	17.2	27.7	24.1	24.0	46.5	35.6	35.8
Distillate fuel oil	17.0	22.1	21.8	21.7	37.8	33.1	33.0	65.8	51.3	51.6
Residual fuel oil.....	6.8	12.6	12.4	12.4	24.5	21.6	21.5	44.2	34.7	34.8
Natural gas ²	3.7	5.9	5.9	6.1	8.8	8.1	7.8	11.9	9.6	9.7
Metallurgical coal	5.4	6.9	6.7	6.6	10.9	9.4	9.2	15.9	12.2	12.0
Other industrial coal	3.4	3.9	3.7	3.7	5.4	4.6	4.5	7.9	6.0	6.1
Coal to liquids	--	--	--	--	--	--	--	--	--	--
Electricity.....	20.3	23.8	23.1	23.0	34.0	29.9	29.3	46.2	35.7	35.7
Transportation										
Propane	18.0	24.0	23.4	23.3	36.4	31.7	31.3	58.6	44.8	44.9
E85 ³	23.3	36.0	35.4	34.4	42.9	41.7	42.0	66.3	58.8	59.5
Motor gasoline ⁴	20.9	25.6	25.1	24.8	40.8	35.9	35.6	67.1	53.6	53.9
Jet fuel ⁵	12.0	18.2	17.9	17.9	32.7	28.8	29.0	59.9	46.6	46.9
Diesel fuel (distillate fuel oil) ⁶	19.8	26.0	25.5	25.4	43.5	37.9	37.7	73.7	57.3	57.5
Residual fuel oil.....	8.1	13.1	12.9	12.8	23.2	20.3	20.3	41.4	32.3	32.5
Natural gas ⁷	16.6	18.6	18.4	18.5	23.5	21.0	20.6	33.7	26.7	26.9
Electricity.....	29.5	37.9	36.5	36.2	58.1	50.5	49.0	78.0	59.8	58.7
Electric power⁸										
Distillate fuel oil	15.0	20.7	20.4	20.4	35.9	31.8	31.8	63.1	49.4	49.9
Residual fuel oil.....	10.2	15.5	15.2	15.2	27.8	24.4	24.4	48.1	37.8	37.9
Natural gas.....	3.3	5.1	5.2	5.3	8.1	7.5	7.2	11.2	9.0	9.2
Steam coal.....	2.2	2.6	2.5	2.5	3.6	3.1	3.0	5.4	4.0	4.0

Table B3. Energy prices by sector and source (continued)
(nominal dollars per million Btu, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Average price to all users⁹										
Propane	14.9	20.5	19.9	19.8	31.3	27.2	26.9	51.0	39.0	39.1
E85 ³	23.3	36.0	35.4	34.4	42.9	41.7	42.0	66.3	58.8	59.5
Motor gasoline ⁴	20.9	25.6	25.1	24.8	40.8	35.9	35.6	67.1	53.6	53.8
Jet fuel ⁵	12.0	18.2	17.9	17.9	32.7	28.8	29.0	59.9	46.6	46.9
Distillate fuel oil	19.1	25.1	24.7	24.6	42.3	36.9	36.8	72.2	56.1	56.5
Residual fuel oil	8.4	13.1	13.0	12.9	23.7	20.8	20.7	42.2	32.9	33.1
Natural gas	5.3	7.4	7.4	7.6	11.1	10.0	9.8	15.4	12.4	12.7
Metallurgical coal	5.4	6.9	6.7	6.6	10.9	9.4	9.2	15.9	12.2	12.0
Other coal	2.3	2.6	2.6	2.6	3.8	3.2	3.2	5.6	4.2	4.2
Coal to liquids	--	--	--	--	--	--	--	--	--	--
Electricity	30.1	35.5	34.1	33.6	50.1	43.1	42.0	67.9	51.6	50.7
Non-renewable energy expenditures by sector (billion nominal dollars)										
Residential	239	281	276	279	393	360	376	548	462	510
Commercial	178	217	213	213	328	292	293	487	387	398
Industrial ¹	168	250	256	269	431	407	430	732	620	678
Transportation	514	643	647	659	915	866	923	1,455	1,307	1,477
Total non-renewable expenditures	1,099	1,391	1,392	1,420	2,066	1,925	2,022	3,223	2,776	3,063
Transportation renewable expenditures	1	2	1	1	14	9	8	24	17	18
Total expenditures	1,100	1,393	1,394	1,422	2,081	1,934	2,030	3,246	2,793	3,081

¹Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

²Excludes use for lease and plant fuel.

³E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

⁴Sales weighted-average price for all grades. Includes Federal, State, and local taxes.

⁵Kerosene-type jet fuel. Includes Federal and State taxes while excluding county and local taxes.

⁶Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes.

⁷Natural gas used as fuel in motor vehicles, trains, and ships. Includes estimated motor vehicle fuel taxes and estimated dispensing costs or charges.

⁸Includes electricity-only and combined heat and power plants that have a regulatory status.

⁹Weighted averages of end-use fuel prices are derived from the prices shown in each sector and the corresponding sectoral consumption.

Btu = British thermal unit.

-- = Not applicable.

Note: Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowmacro.d032516a, ref2016.d032416a, and highmacro.d032516a.

Table B4. Macroeconomic indicators

(billion 2009 chain-weighted dollars, unless otherwise noted)

Indicators	2015	Projections								
		2020			2030			2040		
		Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth	Low economic growth	Reference	High economic growth
Real gross domestic product	16,349	17,576	18,555	19,499	20,749	23,113	25,606	24,511	28,397	32,967
Components of real gross domestic product										
Real consumption	11,221	12,197	12,861	13,436	14,356	16,092	17,863	16,827	19,870	22,954
Real investment	2,842	3,094	3,513	3,939	3,758	4,520	5,283	4,591	5,661	6,935
Real government spending	2,860	2,906	2,967	3,026	3,079	3,222	3,369	3,360	3,602	3,899
Real exports	2,119	2,475	2,615	2,733	3,635	4,178	4,692	4,954	6,113	7,595
Real imports	2,662	3,069	3,374	3,602	4,013	4,824	5,499	5,070	6,683	8,171
Energy intensity										
(thousand Btu per 2009 dollar of GDP)										
Delivered energy	4.38	4.15	4.03	3.94	3.47	3.29	3.16	2.99	2.83	2.68
Total energy	5.92	5.58	5.42	5.30	4.66	4.39	4.22	4.02	3.77	3.58
Price indices										
GDP chain-type price index (2009=1.000)	1.10	1.25	1.21	1.20	1.72	1.49	1.45	2.42	1.85	1.81
Consumer price index (1982-4=1.00)										
All-urban	2.37	2.73	2.65	2.62	3.88	3.35	3.27	5.62	4.27	4.18
Energy commodities and services	2.02	2.48	2.41	2.39	3.83	3.34	3.29	5.93	4.61	4.61
Wholesale price index (1982=1.00)										
All commodities	1.91	2.20	2.14	2.13	3.02	2.59	2.54	4.19	3.16	3.15
Fuel and power	1.60	2.14	2.10	2.10	3.30	2.91	2.87	5.04	3.92	3.96
Metals and metal products	2.01	2.20	2.15	2.18	2.93	2.55	2.55	3.92	3.06	3.24
Industrial commodities excluding energy	1.94	2.20	2.13	2.12	2.97	2.53	2.48	4.03	3.01	2.99
Interest rates (percent, nominal)										
Federal funds rate	0.13	4.91	3.32	2.88	6.10	3.24	2.97	6.20	3.08	3.12
10-year treasury note	2.14	5.55	3.83	3.44	6.66	3.77	3.50	6.87	3.72	3.53
AA utility bond rate	4.01	7.94	5.87	5.07	9.14	5.73	5.02	9.48	5.71	4.67
Value of shipments (billion 2009 dollars)										
Non-industrial and service sectors	24,085	25,327	26,750	28,025	28,651	32,042	35,673	32,130	37,701	44,520
Total industrial	7,229	7,861	8,351	8,889	8,969	9,776	10,707	10,365	11,483	13,187
Agriculture, mining, and construction	1,931	2,270	2,493	2,715	2,408	2,710	2,970	2,604	2,955	3,320
Manufacturing	5,299	5,591	5,858	6,174	6,561	7,066	7,736	7,761	8,528	9,868
Energy-intensive	1,704	1,829	1,892	1,965	2,018	2,147	2,315	2,222	2,417	2,682
Non-energy-intensive	3,594	3,763	3,967	4,208	4,543	4,920	5,421	5,539	6,111	7,186
Total shipments	31,314	33,188	35,101	36,914	37,620	41,818	46,380	42,494	49,184	57,707
Population and employment (millions)										
Population, with armed forces overseas	322	334	335	336	355	360	364	371	381	391
Population, aged 16 and over	257	269	269	270	288	292	295	304	311	319
Population, aged 65 and over	48	57	57	57	74	74	75	83	82	84
Employment, nonfarm	142	146	150	154	154	161	168	163	170	180
Employment, manufacturing	12.5	13.0	13.1	13.5	12.2	13.0	13.2	11.2	12.3	12.7
Key labor indicators										
Labor force (millions)	157	166	167	167	174	177	180	182	188	194
Non-farm labor productivity (2009=1.00)	1.06	1.11	1.15	1.18	1.28	1.37	1.43	1.46	1.63	1.74
Unemployment rate (percent)	5.31	5.12	4.72	4.66	4.98	4.78	4.53	5.01	4.78	4.33
Key indicators for energy demand										
Real disposable personal income	12,225	13,577	14,197	14,748	16,684	17,826	19,420	20,033	21,789	24,273
Housing starts (millions)	1.18	1.24	1.74	2.34	0.97	1.66	2.50	0.85	1.65	2.77
Commercial floorspace (billion square feet)	83.8	88.1	88.7	89.3	96.8	99.3	101.4	105.5	109.8	113.6
Unit sales of light-duty vehicles (millions)	17.4	15.7	17.1	18.3	15.5	17.7	18.7	14.8	19.0	21.3

GDP = Gross domestic product.
Btu = British thermal unit.

Sources: 2015: IHS Economics, Industry and Employment models, November 2015. Projections: EIA, AEO2016 National Energy Modeling System runs lowmacro.d032516a, ref2016.d032416a, and highmacro.d032516a.

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix C

Price case comparisons

Table C1. Total energy supply, disposition, and price summary
(quadrillion Btu per year, unless otherwise noted)

Supply, disposition, and prices	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Production										
Crude oil and lease condensate.....	19.7	17.0	19.6	23.3	14.8	21.0	25.4	18.0	23.5	23.1
Natural gas plant liquids.....	4.4	5.8	6.1	6.4	5.8	6.5	6.9	6.1	6.7	7.0
Dry natural gas.....	28.0	30.1	31.4	31.8	35.6	38.9	41.8	40.0	43.4	48.0
Coal ¹	17.2	17.4	17.5	17.0	13.2	13.3	15.7	13.0	13.1	15.2
Nuclear / uranium ²	8.3	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2
Conventional hydroelectric power.....	2.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9
Biomass ³	4.1	4.2	4.2	4.4	4.2	4.4	4.6	4.3	4.6	4.9
Other renewable energy ⁴	2.6	4.4	4.6	5.5	6.2	6.6	8.7	8.6	8.8	10.8
Other ⁵	0.5	0.8	0.9	0.9	0.8	0.9	0.9	0.9	1.0	1.0
Total.....	87.3	90.6	95.4	100.2	91.7	102.7	115.2	101.9	112.2	121.2
Imports										
Crude oil.....	16.1	15.8	16.8	15.8	17.3	16.0	13.5	18.9	15.9	16.7
Petroleum and other liquids ⁶	3.9	5.1	4.5	4.2	5.7	4.3	3.6	5.8	4.3	3.4
Natural gas ⁷	2.8	2.0	2.1	2.1	1.5	1.6	1.8	1.3	1.4	2.1
Other imports ⁸	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.5
Total.....	23.2	23.1	23.6	22.2	24.6	22.0	19.0	26.2	21.8	22.7
Exports										
Petroleum and other liquids ⁹	9.0	7.1	11.6	16.0	7.2	13.5	19.5	10.5	15.2	21.0
Natural gas ¹⁰	1.8	4.2	5.0	5.0	5.5	7.6	10.8	6.9	9.0	12.7
Coal.....	2.0	1.9	1.9	1.7	2.1	1.9	1.7	2.4	2.3	1.9
Total.....	12.8	13.1	18.5	22.7	14.7	23.0	32.0	19.8	26.6	35.6
Discrepancy¹¹.....	1.0	0.1	0.0	-0.1	0.2	0.1	0.2	0.2	0.3	0.3
Consumption										
Petroleum and other liquids ¹²	36.5	38.8	37.8	36.3	38.4	36.6	33.7	40.5	37.5	33.9
Natural gas.....	28.3	27.7	28.3	28.6	31.3	32.5	31.5	34.0	35.4	35.3
Coal ¹³	15.5	15.5	15.6	15.1	11.1	11.3	13.5	10.5	10.7	13.1
Nuclear / uranium ²	8.3	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2
Conventional hydroelectric power.....	2.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9
Biomass ¹⁴	2.8	2.7	2.8	2.9	2.8	3.0	3.2	2.9	3.1	3.4
Other renewable energy ⁴	2.6	4.4	4.6	5.5	6.2	6.6	8.7	8.6	8.8	10.8
Other ¹⁵	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total.....	96.7	100.5	100.5	99.7	101.4	101.5	102.0	108.1	107.1	108.0
Prices (2015 dollars per unit)										
Crude oil spot prices (dollars per barrel)										
Brent.....	52	38	77	152	49	104	207	73	136	230
West Texas Intermediate.....	49	32	71	145	42	97	198	67	129	222
Natural gas at Henry Hub										
(dollars per million Btu).....	2.62	3.85	4.43	4.40	4.65	5.06	7.92	4.54	4.86	7.74
Coal (dollars per ton)										
at the minemouth ¹⁶	33.8	30.8	33.6	36.7	32.3	33.8	36.8	36.3	38.7	42.0
Coal (dollars per million Btu)										
at the minemouth ¹⁶	1.69	1.57	1.68	1.82	1.63	1.71	1.86	1.80	1.91	2.08
Average end-use ¹⁷	2.37	2.31	2.43	2.62	2.34	2.55	2.78	2.45	2.68	2.85
Average electricity (cents per kilowatthour)...	10.3	10.3	10.5	10.6	10.6	10.9	11.6	10.3	10.5	11.3

Table C1. Total energy supply, disposition, and price summary (continued)
(quadrillion Btu per year, unless otherwise noted)

Supply, disposition, and prices	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Prices (nominal dollars per unit)										
Crude oil spot prices (dollars per barrel)										
Brent.....	52	42	85	166	66	141	284	121	229	397
West Texas Intermediate	49	35	79	159	58	131	272	111	217	384
Natural gas at Henry Hub (dollars per million Btu)	2.62	4.25	4.90	4.83	6.31	6.84	10.90	7.54	8.17	13.36
Coal (dollars per ton)										
at the minemouth ¹⁶	33.8	34.0	37.1	40.3	43.8	45.8	50.6	60.2	65.1	72.5
Coal (dollars per million Btu)										
at the minemouth ¹⁶	1.69	1.73	1.86	1.99	2.21	2.31	2.55	2.99	3.21	3.59
Average end-use ¹⁷	2.37	2.55	2.69	2.87	3.18	3.45	3.82	4.06	4.50	4.92
Average electricity (cents per kilowatthour)...	10.3	11.4	11.6	11.7	14.4	14.7	16.0	17.1	17.6	19.5

¹Includes waste coal.

²These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

³Includes grid-connected electricity from wood and wood waste; biomass, such as corn, used for liquid fuels production; and non-electric energy demand from wood. Refer to Table A17 for details.

⁴Includes grid-connected electricity from landfill gas; biogenic municipal waste; wind; photovoltaic and solar thermal sources; and non-electric energy from renewable sources, such as active and passive solar systems. Excludes electricity imports using renewable sources and nonmarketed renewable energy. See Table A17 for selected nonmarketed residential and commercial renewable energy data.

⁵Includes non-biogenic municipal waste, liquid hydrogen, methanol, and some domestic inputs to refineries.

⁶Includes imports of finished petroleum products, unfinished oils, alcohols, ethers, blending components, and renewable fuels such as ethanol.

⁷Includes imports of liquefied natural gas that are later re-exported.

⁸Includes coal, coal coke (net), and electricity (net). Excludes imports of fuel used in nuclear power plants.

⁹Includes crude oil, petroleum products, ethanol, and biodiesel.

¹⁰Includes re-exported liquefied natural gas.

¹¹Balancing item. Includes unaccounted for supply, losses, gains, and net storage withdrawals.

¹²Estimated consumption. Includes petroleum-derived fuels and non-petroleum derived fuels, such as ethanol and biodiesel, and coal-based synthetic liquids. Petroleum coke, which is a solid, is included. Also included are hydrocarbon gas liquids and crude oil consumed as a fuel. Refer to Table A17 for detailed renewable liquid fuels consumption.

¹³Excludes coal converted to coal-based synthetic liquids and natural gas.

¹⁴Includes grid-connected electricity from wood and wood waste, non-electric energy from wood, and biofuels heat and coproducts used in the production of liquid fuels, but excludes the energy content of the liquid fuels.

¹⁵Includes non-biogenic municipal waste, liquid hydrogen, and net electricity imports.

¹⁶Includes reported prices for both open market and captive mines. Prices weighted by production, which differs from average minemouth prices published in EIA data reports where it is weighted by reported sales.

¹⁷Prices weighted by consumption; weighted average excludes export free-alongside-ship (f.a.s.) prices.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowprice.d041916a, ref2016.d032416a, and highprice.d041916a.

Table C2. Energy consumption by sector and source
(quadrillion Btu per year, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Energy consumption										
Residential										
Propane	0.43	0.44	0.42	0.39	0.41	0.38	0.33	0.37	0.34	0.29
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Distillate fuel oil	0.50	0.46	0.43	0.39	0.37	0.34	0.30	0.30	0.27	0.24
Petroleum and other liquids subtotal.....	0.93	0.91	0.86	0.79	0.78	0.72	0.63	0.67	0.61	0.54
Natural gas	4.77	4.90	4.87	4.87	4.83	4.80	4.72	4.76	4.73	4.62
Renewable energy ¹	0.44	0.34	0.42	0.54	0.30	0.39	0.51	0.29	0.37	0.45
Electricity	4.78	4.80	4.76	4.70	4.89	4.83	4.72	5.26	5.20	5.04
Delivered energy	10.92	10.95	10.90	10.90	10.81	10.74	10.58	10.99	10.91	10.65
Electricity related losses	9.44	9.43	9.37	9.27	8.85	8.77	8.93	9.25	9.15	9.32
Total	20.37	20.37	20.27	20.17	19.66	19.50	19.50	20.24	20.05	19.97
Commercial										
Propane	0.17	0.20	0.18	0.15	0.22	0.19	0.16	0.23	0.20	0.18
Motor gasoline ²	0.04	0.07	0.06	0.05	0.08	0.06	0.05	0.08	0.07	0.06
Kerosene	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
Distillate fuel oil	0.37	0.40	0.36	0.31	0.38	0.32	0.27	0.34	0.29	0.25
Residual fuel oil.....	0.07	0.17	0.11	0.07	0.16	0.10	0.07	0.13	0.10	0.08
Petroleum and other liquids subtotal.....	0.66	0.84	0.70	0.58	0.84	0.68	0.56	0.79	0.67	0.57
Natural gas	3.32	3.49	3.45	3.47	3.59	3.53	3.41	3.85	3.81	3.60
Coal	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Renewable energy ³	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Electricity	4.64	4.71	4.69	4.66	5.13	5.09	4.99	5.67	5.62	5.50
Delivered energy	8.81	9.23	9.03	8.91	9.74	9.49	9.14	10.51	10.28	9.86
Electricity related losses	9.16	9.25	9.23	9.19	9.29	9.23	9.43	9.97	9.89	10.16
Total	17.97	18.48	18.26	18.09	19.03	18.72	18.58	20.48	20.17	20.01
Industrial⁴										
Liquefied petroleum gases and other ⁵	2.38	3.05	3.10	3.03	3.59	3.66	3.57	4.17	4.22	4.06
Motor gasoline ²	0.27	0.27	0.28	0.28	0.26	0.27	0.26	0.27	0.27	0.26
Distillate fuel oil	1.34	1.50	1.44	1.39	1.46	1.44	1.38	1.49	1.47	1.38
Residual fuel oil.....	0.04	0.08	0.04	0.03	0.09	0.06	0.05	0.07	0.05	0.05
Petrochemical feedstocks	0.66	0.92	0.96	0.94	1.28	1.31	1.28	1.63	1.66	1.59
Other petroleum ⁶	3.38	3.64	3.59	3.73	3.75	3.82	3.71	4.23	4.15	3.97
Petroleum and other liquids subtotal.....	8.07	9.46	9.40	9.39	10.42	10.55	10.26	11.85	11.82	11.31
Natural gas	7.75	7.84	8.55	8.71	8.50	9.13	9.17	9.47	9.89	9.72
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.08	0.00	0.00	0.84	0.00	0.00	1.60
Lease and plant fuel ⁷	1.63	1.69	1.76	1.79	1.87	2.06	2.21	2.11	2.31	2.54
Natural gas liquefaction for export ⁸	0.00	0.17	0.26	0.26	0.29	0.53	0.87	0.45	0.69	1.10
Natural gas subtotal.....	9.38	9.70	10.57	10.83	10.65	11.72	13.08	12.03	12.89	14.95
Metallurgical coal	0.54	0.40	0.41	0.50	0.34	0.47	0.50	0.30	0.40	0.33
Other industrial coal	0.82	0.80	0.82	0.86	0.81	0.88	0.91	0.84	0.93	0.97
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.75
Net coal coke imports	-0.02	-0.03	-0.01	-0.03	-0.02	0.00	-0.01	-0.01	0.01	0.00
Coal subtotal.....	1.34	1.17	1.23	1.34	1.13	1.35	2.05	1.13	1.34	2.04
Biofuels heat and coproducts.....	0.78	0.84	0.83	0.82	0.80	0.81	0.83	0.81	0.84	0.92
Renewable energy ⁹	1.48	1.44	1.48	1.53	1.53	1.67	1.71	1.62	1.79	1.85
Electricity	3.27	3.54	3.61	3.71	3.77	3.98	4.05	4.08	4.26	4.28
Delivered energy	24.33	26.16	27.11	27.62	28.31	30.07	31.99	31.51	32.94	35.37
Electricity related losses	6.46	6.96	7.11	7.32	6.82	7.22	7.66	7.16	7.50	7.92
Total	30.79	33.12	34.22	34.94	35.13	37.29	39.65	38.67	40.44	43.28

Table C2. Energy consumption by sector and source (continued)
(quadrillion Btu per year, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Transportation										
Propane	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
Motor gasoline ²	17.01	17.51	16.79	15.39	15.55	13.62	11.48	15.18	12.55	10.19
of which: E85 ¹⁰	0.05	0.04	0.04	0.18	0.08	0.22	0.56	0.14	0.28	0.63
Jet fuel ¹¹	2.84	3.02	2.99	2.95	3.34	3.32	3.28	3.58	3.56	3.53
Distillate fuel oil ¹²	6.67	6.97	6.99	7.04	7.30	7.49	7.10	8.24	8.01	7.28
Residual fuel oil	0.45	0.38	0.37	0.36	0.41	0.42	0.43	0.45	0.45	0.47
Other petroleum ¹³	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Petroleum and other liquids subtotal	27.14	28.05	27.32	25.91	26.77	25.01	22.46	27.64	24.75	21.66
Pipeline fuel natural gas	0.89	0.80	0.83	0.85	0.86	0.94	1.07	0.94	1.07	1.27
Compressed / liquefied natural gas	0.07	0.08	0.08	0.13	0.07	0.17	0.75	0.09	0.59	1.58
Liquid hydrogen	0.00	0.01	0.01	0.01	0.05	0.04	0.04	0.07	0.06	0.05
Electricity	0.03	0.05	0.05	0.05	0.11	0.11	0.11	0.16	0.15	0.15
Delivered energy	28.13	28.98	28.29	26.95	27.86	26.28	24.43	28.90	26.63	24.72
Electricity related losses	0.06	0.09	0.09	0.10	0.21	0.20	0.21	0.29	0.27	0.28
Total	28.19	29.07	28.38	27.04	28.07	26.48	24.64	29.19	26.90	25.00
Unspecified sector¹⁴	-0.58	-0.60	-0.58	-0.53	-0.52	-0.46	-0.36	-0.52	-0.42	-0.30
Delivered energy consumption for all Sectors										
Liquefied petroleum gases and other ⁵	2.99	3.69	3.71	3.57	4.22	4.24	4.07	4.79	4.79	4.55
Motor gasoline ²	16.96	17.25	16.55	15.20	15.35	13.49	11.42	15.01	12.47	10.18
of which: E85 ¹⁰	0.05	0.04	0.04	0.18	0.08	0.22	0.56	0.14	0.28	0.63
Jet fuel ¹¹	3.18	3.26	3.22	3.17	3.60	3.58	3.53	3.85	3.83	3.80
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Distillate fuel oil	8.33	9.09	8.98	8.89	9.26	9.33	8.82	10.09	9.77	8.91
Residual fuel oil	0.56	0.63	0.52	0.46	0.66	0.57	0.55	0.65	0.60	0.60
Petrochemical feedstocks	0.66	0.92	0.96	0.94	1.28	1.31	1.28	1.63	1.66	1.59
Other petroleum ¹⁵	3.54	3.81	3.75	3.88	3.91	3.98	3.87	4.39	4.31	4.13
Petroleum and other liquids subtotal	36.23	38.66	37.70	36.14	38.29	36.51	33.55	40.43	37.44	33.77
Natural gas	15.90	16.30	16.95	17.19	16.99	17.63	18.04	18.18	19.02	19.51
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.08	0.00	0.00	0.84	0.00	0.00	1.60
Lease and plant fuel ⁷	1.63	1.69	1.76	1.79	1.87	2.06	2.21	2.11	2.31	2.54
Natural gas liquefaction for export ⁸	0.00	0.17	0.26	0.26	0.29	0.53	0.87	0.45	0.69	1.10
Pipeline natural gas	0.89	0.80	0.83	0.85	0.86	0.94	1.07	0.94	1.07	1.27
Natural gas subtotal	18.43	18.96	19.80	20.17	20.00	21.16	23.02	21.67	23.09	26.02
Metallurgical coal	0.54	0.40	0.41	0.50	0.34	0.47	0.50	0.30	0.40	0.33
Other coal	0.88	0.85	0.88	0.91	0.86	0.93	0.97	0.90	0.98	1.02
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.75
Net coal coke imports	-0.02	-0.03	-0.01	-0.03	-0.02	0.00	-0.01	-0.01	0.01	0.00
Coal subtotal	1.40	1.23	1.28	1.39	1.18	1.40	2.11	1.19	1.39	2.10
Biofuels heat and coproducts	0.78	0.84	0.83	0.82	0.80	0.81	0.83	0.81	0.84	0.92
Renewable energy ¹⁶	2.06	1.92	2.03	2.20	1.97	2.19	2.36	2.05	2.29	2.44
Liquid hydrogen	0.00	0.01	0.01	0.01	0.05	0.04	0.04	0.07	0.06	0.05
Electricity	12.72	13.10	13.11	13.12	13.90	14.01	13.87	15.18	15.23	14.97
Delivered energy	71.62	74.73	74.75	73.85	76.20	76.12	75.77	81.40	80.34	80.28
Electricity related losses	25.12	25.73	25.80	25.88	25.17	25.41	26.23	26.66	26.81	27.68
Total	96.74	100.45	100.55	99.72	101.38	101.54	102.01	108.05	107.15	107.96
Electric power¹⁷										
Distillate fuel oil	0.09	0.09	0.09	0.08	0.06	0.06	0.07	0.05	0.05	0.06
Residual fuel oil	0.17	0.06	0.06	0.06	0.04	0.04	0.04	0.03	0.03	0.03
Petroleum and other liquids subtotal	0.26	0.15	0.15	0.14	0.11	0.11	0.11	0.09	0.09	0.09
Natural gas	9.89	8.76	8.50	8.40	11.33	11.34	8.44	12.30	12.31	9.28
Steam coal	14.08	14.25	14.34	13.74	9.94	9.92	11.36	9.36	9.36	10.97
Nuclear / uranium ¹⁸	8.34	8.12	8.12	8.12	8.25	8.25	8.25	8.25	8.25	8.25
Renewable energy ¹⁹	4.86	7.13	7.37	8.17	9.05	9.41	11.55	11.47	11.67	13.70
Non-biogenic municipal waste	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Electricity imports	0.19	0.19	0.19	0.19	0.17	0.17	0.17	0.15	0.15	0.15
Total	37.85	38.83	38.90	39.00	39.08	39.42	40.10	41.84	42.04	42.65

Table C2. Energy consumption by sector and source (continued)
(quadrillion Btu per year, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Total energy consumption										
Liquefied petroleum gases and other ⁵	2.99	3.69	3.71	3.57	4.22	4.24	4.07	4.79	4.79	4.55
Motor gasoline ²	16.96	17.25	16.55	15.20	15.35	13.49	11.42	15.01	12.47	10.18
of which: E85 ¹⁰	0.05	0.04	0.04	0.18	0.08	0.22	0.56	0.14	0.28	0.63
Jet fuel ¹¹	3.18	3.26	3.22	3.17	3.60	3.58	3.53	3.85	3.83	3.80
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Distillate fuel oil	8.42	9.18	9.07	8.98	9.33	9.40	8.88	10.14	9.82	8.97
Residual fuel oil	0.73	0.69	0.58	0.52	0.70	0.62	0.59	0.68	0.64	0.63
Petrochemical feedstocks	0.66	0.92	0.96	0.94	1.28	1.31	1.28	1.63	1.66	1.59
Other petroleum ¹⁵	3.54	3.81	3.75	3.88	3.91	3.98	3.87	4.39	4.31	4.13
Petroleum and other liquids subtotal	36.49	38.81	37.85	36.28	38.40	36.62	33.66	40.52	37.52	33.86
Natural gas	25.79	25.06	25.45	25.59	28.32	28.97	26.47	30.48	31.33	28.79
Natural-gas-to-liquids heat and power	0.00	0.00	0.00	0.08	0.00	0.00	0.84	0.00	0.00	1.60
Lease and plant fuel ⁷	1.63	1.69	1.76	1.79	1.87	2.06	2.21	2.11	2.31	2.54
Natural gas liquefaction for export ⁸	0.00	0.17	0.26	0.26	0.29	0.53	0.87	0.45	0.69	1.10
Pipeline natural gas	0.89	0.80	0.83	0.85	0.86	0.94	1.07	0.94	1.07	1.27
Natural gas subtotal	28.31	27.72	28.30	28.57	31.33	32.51	31.46	33.98	35.39	35.30
Metallurgical coal	0.54	0.40	0.41	0.50	0.34	0.47	0.50	0.30	0.40	0.33
Other coal	14.96	15.10	15.22	14.65	10.81	10.86	12.33	10.26	10.34	11.99
Coal-to-liquids heat and power	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.75
Net coal coke imports	-0.02	-0.03	-0.01	-0.03	-0.02	0.00	-0.01	-0.01	0.01	0.00
Coal subtotal	15.48	15.48	15.62	15.13	11.13	11.32	13.47	10.55	10.75	13.06
Nuclear / uranium ¹⁸	8.34	8.12	8.12	8.12	8.25	8.25	8.25	8.25	8.25	8.25
Biofuels heat and coproducts	0.78	0.84	0.83	0.82	0.80	0.81	0.83	0.81	0.84	0.92
Renewable energy ²⁰	6.92	9.05	9.40	10.38	11.02	11.60	13.90	13.52	13.96	16.14
Liquid hydrogen	0.00	0.01	0.01	0.01	0.05	0.04	0.04	0.07	0.06	0.05
Non-biogenic municipal waste	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Electricity imports	0.19	0.19	0.19	0.19	0.17	0.17	0.17	0.15	0.15	0.15
Total	96.74	100.45	100.55	99.72	101.38	101.54	102.01	108.05	107.15	107.96
Energy use and related statistics										
Delivered energy use	71.62	74.73	74.75	73.85	76.20	76.12	75.77	81.40	80.34	80.28
Total energy use	96.74	100.45	100.55	99.72	101.38	101.54	102.01	108.05	107.15	107.96
Ethanol consumed in motor gasoline and E85	1.18	1.22	1.19	1.18	1.13	1.12	1.17	1.14	1.24	1.06
Population (millions)	322	335	335	335	360	360	360	381	381	381
Gross domestic product (billion 2009 dollars) ..	16,349	18,768	18,555	18,420	23,076	23,113	23,021	28,506	28,397	28,246
Carbon dioxide emissions (million metric tons)	5,273	5,327	5,289	5,145	5,018	4,961	4,888	5,181	5,044	5,001

¹Includes wood used for residential heating. See Table A4 and/or Table A17 for estimates of nonmarketed renewable energy consumption for geothermal heat pumps, solar thermal water heating, and electricity generation from wind and solar photovoltaic sources.

²Includes ethanol and ethers blended into gasoline.

³Excludes ethanol. Includes commercial sector consumption of wood and wood waste, landfill gas, municipal waste, and other biomass for combined heat and power. See Table A5 and/or Table A17 for estimates of nonmarketed renewable energy consumption for solar thermal water heating and electricity generation from wind and solar photovoltaic sources.

⁴Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

⁵Includes ethane, natural gasoline, and refinery olefins.

⁶Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

⁷Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.

⁸Fuel used in facilities that liquefy natural gas for export.

⁹Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources. Excludes ethanol in motor gasoline.

¹⁰E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

¹¹Includes only kerosene type.

¹²Diesel fuel for on- and off- road use.

¹³Includes aviation gasoline and lubricants.

¹⁴Represents consumption unattributed to the sectors above.

¹⁵Includes aviation gasoline, petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

¹⁶Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes ethanol and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

¹⁷Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

¹⁸These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

¹⁹Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes net electricity imports.

²⁰Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes ethanol, net electricity imports, and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

Btu = British thermal unit.

Note: Includes estimated consumption for petroleum and other liquids. Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowprice.d041916a, ref2016.d032416a, and highprice.d041916a.

Table C3. Energy prices by sector and source
(2012 dollars per million Btu, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil Price	Reference	High oil price
Residential										
Propane	16.9	16.1	20.2	29.2	17.0	22.4	33.6	19.4	25.6	34.5
Distillate fuel oil	19.3	14.9	22.4	36.4	17.2	27.8	46.7	21.8	33.8	50.9
Natural gas	10.1	10.3	10.7	10.6	11.6	12.0	13.6	11.9	12.3	14.4
Electricity	36.3	36.9	37.7	38.4	38.2	39.4	42.1	37.3	38.1	40.9
Commercial										
Propane	15.1	14.4	17.9	25.6	15.1	19.8	29.5	17.2	22.5	30.3
Distillate fuel oil	17.0	12.2	19.7	33.7	13.9	24.4	43.4	18.5	30.5	47.6
Residual fuel oil	6.9	4.6	11.0	21.8	6.6	15.3	30.1	10.9	19.9	33.5
Natural gas	7.7	8.9	9.3	9.1	9.9	10.4	12.0	10.0	10.4	12.4
Electricity	30.6	30.9	31.5	31.8	31.3	32.3	34.7	30.0	30.7	33.4
Industrial¹										
Propane	12.2	11.4	15.6	24.8	12.3	17.8	29.4	14.8	21.1	30.3
Distillate fuel oil	17.0	12.2	19.7	33.6	13.9	24.4	43.4	18.5	30.5	47.6
Residual fuel oil	6.8	4.9	11.3	22.0	7.3	15.9	30.8	11.6	20.6	34.1
Natural gas ²	3.7	5.0	5.4	5.2	5.6	6.0	7.7	5.4	5.7	7.5
Metallurgical coal	5.4	6.0	6.0	6.0	7.0	7.0	7.0	7.3	7.3	7.3
Other industrial coal	3.4	3.3	3.4	3.6	3.2	3.4	3.7	3.3	3.6	3.9
Coal to liquids	--	--	--	--	--	--	2.0	--	--	2.1
Electricity	20.3	20.5	20.9	21.1	21.4	22.1	24.0	20.8	21.2	23.5
Transportation										
Propane	18.0	17.1	21.2	30.2	18.0	23.4	34.7	20.4	26.6	35.6
E85 ³	23.3	24.1	32.0	38.1	25.4	30.8	39.3	28.5	35.0	42.2
Motor gasoline ⁴	20.9	16.1	22.7	35.6	16.9	26.5	43.0	21.0	31.8	47.0
Jet fuel ⁵	12.0	8.6	16.2	29.6	10.9	21.3	40.1	16.0	27.7	44.7
Diesel fuel (distillate fuel oil) ⁶	19.8	15.7	23.1	37.0	17.5	28.0	46.9	22.0	34.1	51.2
Residual fuel oil	8.1	4.9	11.7	21.6	5.6	15.0	28.3	10.9	19.2	31.2
Natural gas ⁷	16.6	16.4	16.6	16.4	16.1	15.5	18.8	15.5	15.9	18.5
Electricity	29.5	32.5	33.0	33.5	36.5	37.4	39.5	35.0	35.5	37.9
Electric power⁸										
Distillate fuel oil	15.0	10.9	18.4	32.4	12.9	23.5	42.5	17.4	29.4	46.6
Residual fuel oil	10.2	7.4	13.8	24.6	9.4	18.1	32.9	13.4	22.4	36.0
Natural gas	3.3	4.4	4.7	4.5	5.2	5.6	7.1	5.0	5.4	7.1
Steam coal	2.2	2.1	2.3	2.4	2.1	2.3	2.6	2.2	2.4	2.7
Average price to all users⁹										
Propane	14.9	13.9	18.0	26.9	14.8	20.1	31.1	17.1	23.2	31.9
E85 ³	23.3	24.1	32.0	38.1	25.4	30.8	39.3	28.5	35.0	42.2
Motor gasoline ⁴	20.9	16.1	22.7	35.6	16.9	26.5	43.0	21.0	31.8	47.0
Jet fuel ⁵	12.0	8.6	16.2	29.6	10.9	21.3	40.1	16.0	27.7	44.7
Distillate fuel oil	19.1	14.8	22.3	36.3	16.7	27.3	46.2	21.4	33.3	50.5
Residual fuel oil	8.4	5.0	11.7	22.0	6.3	15.4	29.0	11.1	19.6	31.9
Natural gas	5.3	6.4	6.7	6.6	7.0	7.4	9.4	6.9	7.4	9.6
Metallurgical coal	5.4	6.0	6.0	6.0	7.0	7.0	7.0	7.3	7.3	7.3
Other coal	2.3	2.2	2.3	2.5	2.2	2.4	2.7	2.3	2.5	2.8
Coal to liquids	--	--	--	--	--	--	2.0	--	--	2.1
Electricity	30.1	30.3	30.8	31.1	31.1	31.9	34.1	30.1	30.6	33.1
Non-renewable energy expenditures by sector (billion 2015 dollars)										
Residential	239	242	250	258	256	266	288	267	274	296
Commercial	178	186	193	198	208	216	235	223	230	251
Industrial ¹	168	184	232	309	222	301	444	275	369	509
Transportation	514	411	586	885	426	640	956	559	777	1,023
Total non-renewable expenditures	1,099	1,023	1,260	1,650	1,112	1,423	1,923	1,324	1,650	2,079
Transportation renewable expenditures	1	1	1	7	2	7	22	4	10	26
Total expenditures	1,100	1,024	1,262	1,657	1,114	1,430	1,945	1,328	1,660	2,106

Table C3. Energy prices by sector and source (continued)
(nominal dollars per million Btu, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Residential										
Propane	16.9	17.8	22.3	32.0	23.1	30.3	46.3	32.2	43.0	59.6
Distillate fuel oil	19.3	16.4	24.7	39.9	23.3	37.6	64.2	36.2	56.9	88.0
Natural gas	10.1	11.4	11.9	11.6	15.7	16.3	18.8	19.8	20.8	24.9
Electricity	36.3	40.7	41.7	42.1	51.8	53.3	57.9	61.9	64.2	70.7
Commercial										
Propane	15.1	15.9	19.8	28.1	20.6	26.8	40.6	28.6	37.9	52.3
Distillate fuel oil	17.0	13.5	21.8	36.9	18.8	33.1	59.7	30.7	51.2	82.2
Residual fuel oil	6.9	5.1	12.1	23.9	9.0	20.7	41.4	18.1	33.6	57.8
Natural gas	7.7	9.8	10.3	10.0	13.5	14.1	16.5	16.6	17.5	21.4
Electricity	30.6	34.1	34.8	34.9	42.5	43.7	47.7	49.9	51.7	57.6
Industrial¹										
Propane	12.2	12.6	17.2	27.2	16.7	24.1	40.5	24.6	35.6	52.4
Distillate fuel oil	17.0	13.5	21.8	36.9	18.9	33.1	59.7	30.7	51.3	82.2
Residual fuel oil	6.8	5.4	12.4	24.1	9.9	21.6	42.3	19.2	34.7	58.9
Natural gas ²	3.7	5.5	5.9	5.7	7.6	8.1	10.6	9.0	9.6	13.0
Metallurgical coal	5.4	6.7	6.7	6.6	9.5	9.4	9.7	12.0	12.2	12.6
Other industrial coal	3.4	3.6	3.7	4.0	4.4	4.6	5.1	5.5	6.0	6.7
Coal to liquids	--	--	--	--	--	--	2.8	--	--	3.6
Electricity	20.3	22.7	23.1	23.2	29.1	29.9	33.0	34.6	35.7	40.5
Transportation										
Propane	18.0	18.9	23.4	33.2	24.5	31.7	47.7	34.0	44.8	61.4
E85 ³	23.3	26.6	35.4	41.8	34.5	41.7	54.0	47.3	58.8	72.8
Motor gasoline ⁴	20.9	17.8	25.1	39.0	23.0	35.9	59.2	34.9	53.6	81.1
Jet fuel ⁵	12.0	9.5	17.9	32.5	14.8	28.8	55.1	26.5	46.6	77.2
Diesel fuel (distillate fuel oil) ⁶	19.8	17.3	25.5	40.6	23.7	37.9	64.6	36.6	57.3	88.4
Residual fuel oil	8.1	5.4	12.9	23.7	7.6	20.3	38.9	18.1	32.3	53.9
Natural gas ⁷	16.6	18.1	18.4	18.0	21.9	21.0	25.8	25.7	26.7	31.9
Electricity	29.5	35.9	36.5	36.8	49.6	50.5	54.4	58.2	59.8	65.5
Electric power⁸										
Distillate fuel oil	15.0	12.1	20.4	35.6	17.5	31.8	58.4	28.9	49.4	80.5
Residual fuel oil	10.2	8.2	15.2	27.0	12.7	24.4	45.2	22.2	37.8	62.1
Natural gas	3.3	4.8	5.2	4.9	7.0	7.5	9.7	8.3	9.0	12.2
Steam coal	2.2	2.4	2.5	2.7	2.8	3.1	3.5	3.7	4.0	4.7

Table C3. Energy prices by sector and source (continued)
(nominal dollars per million Btu, unless otherwise noted)

Sector and source	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Average price to all users⁹										
Propane	14.9	15.4	19.9	29.5	20.1	27.2	42.8	28.4	39.0	55.1
E85 ³	23.3	26.6	35.4	41.8	34.5	41.7	54.0	47.3	58.8	72.8
Motor gasoline ⁴	20.9	17.8	25.1	39.0	23.0	35.9	59.2	34.9	53.6	81.1
Jet fuel ⁵	12.0	9.5	17.9	32.5	14.8	28.8	55.1	26.5	46.6	77.2
Distillate fuel oil	19.1	16.4	24.7	39.8	22.7	36.9	63.6	35.5	56.1	87.2
Residual fuel oil	8.4	5.6	13.0	24.1	8.6	20.8	39.9	18.4	32.9	55.1
Natural gas	5.3	7.0	7.4	7.2	9.6	10.0	12.9	11.5	12.4	16.6
Metallurgical coal	5.4	6.7	6.7	6.6	9.5	9.4	9.7	12.0	12.2	12.6
Other coal	2.3	2.4	2.6	2.7	3.0	3.2	3.7	3.8	4.2	4.8
Coal to liquids	--	--	--	--	--	--	2.8	--	--	3.6
Electricity	30.1	33.4	34.1	34.2	42.2	43.1	47.0	50.0	51.6	57.2
Non-renewable energy expenditures by sector (billion nominal dollars)										
Residential	239	267	276	283	347	360	396	443	462	510
Commercial	178	206	213	217	282	292	323	370	387	434
Industrial ¹	168	203	256	340	301	407	611	457	620	879
Transportation	514	454	647	972	579	866	1,315	929	1,307	1,767
Total non-renewable expenditures	1,099	1,130	1,392	1,811	1,509	1,925	2,645	2,199	2,776	3,590
Transportation renewable expenditures	1	1	1	7	3	9	30	7	17	46
Total expenditures	1,100	1,131	1,394	1,819	1,512	1,934	2,676	2,205	2,793	3,636

¹Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

²Excludes use for lease and plant fuel.

³E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

⁴Sales weighted-average price for all grades. Includes Federal, State, and local taxes.

⁵Kerosene-type jet fuel. Includes Federal and State taxes while excluding county and local taxes.

⁶Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes.

⁷Natural gas used as fuel in motor vehicles, trains, and ships. Includes estimated motor vehicle fuel taxes and estimated dispensing costs or charges.

⁸Includes electricity-only and combined heat and power plants that have a regulatory status.

⁹Weighted averages of end-use fuel prices are derived from the prices shown in each sector and the corresponding sectoral consumption.

Btu = British thermal unit.

-- = Not applicable.

Note: Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowprice.d041916a, ref2016.d032416a, and highprice.d041916a.

Table C4. Petroleum and other liquids supply and disposition
(million barrels per day, unless otherwise noted)

Supply and disposition	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Crude oil										
Domestic crude production ¹	9.42	8.13	9.38	11.16	7.10	10.06	12.14	8.62	11.26	11.02
Alaska	0.48	0.41	0.41	0.41	0.00	0.24	0.24	0.00	0.15	0.15
Lower 48 states	8.94	7.72	8.96	10.75	7.09	9.82	11.90	8.61	11.11	10.88
Net imports	6.88	6.51	6.97	6.49	7.13	6.57	4.47	7.86	6.10	5.54
Gross imports	7.28	7.14	7.60	7.12	7.76	7.20	6.04	8.49	7.12	7.47
Exports	0.40	0.63	0.63	0.63	0.63	0.63	1.57	0.63	1.02	1.93
Other crude supply ²	-0.11	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Total crude supply	16.19	14.65	16.36	17.66	14.23	16.63	16.61	16.48	17.36	16.56
Net product imports	-2.24	-0.71	-3.26	-5.83	-0.28	-4.32	-6.83	-1.76	-4.66	-7.24
Gross refined product imports ³	0.66	1.13	1.11	0.79	1.71	1.30	0.82	1.91	1.63	1.10
Unfinished oil imports	0.55	0.64	0.53	0.54	0.65	0.46	0.45	0.66	0.39	0.35
Blending component imports	0.67	0.72	0.58	0.62	0.63	0.45	0.45	0.53	0.30	0.32
Exports	4.12	3.21	5.48	7.78	3.28	6.52	8.56	4.86	6.98	9.01
Refinery processing gain ⁴	1.03	0.97	1.05	1.14	0.92	0.98	0.95	1.03	0.99	0.94
Product stock withdrawal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Natural gas plant liquids	3.25	4.33	4.57	4.82	4.32	4.90	5.17	4.53	4.99	5.25
Supply from renewable sources	1.01	1.11	1.08	1.08	1.03	1.03	1.08	1.04	1.12	1.22
Ethanol	0.89	0.92	0.89	0.89	0.84	0.84	0.88	0.85	0.93	0.79
Domestic production	0.94	0.93	0.90	0.89	0.88	0.87	0.89	0.89	0.91	0.69
Net imports	-0.05	-0.01	-0.01	0.00	-0.04	-0.03	-0.01	-0.03	0.02	0.11
Stock withdrawal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Biodiesel	0.11	0.15	0.15	0.16	0.04	0.10	0.16	0.04	0.10	0.16
Domestic production	0.08	0.11	0.11	0.12	0.00	0.06	0.12	0.00	0.06	0.12
Net imports	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Stock withdrawal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other biomass-derived liquids ⁵	0.00	0.04	0.04	0.04	0.14	0.09	0.04	0.14	0.09	0.27
Domestic production	0.00	0.04	0.04	0.04	0.14	0.09	0.04	0.14	0.09	0.27
Net imports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock withdrawal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liquids from gas	0.00	0.00	0.00	0.04	0.00	0.00	0.45	0.00	0.00	0.85
Liquids from coal	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.28
Other ⁶	0.21	0.22	0.28	0.30	0.24	0.30	0.32	0.28	0.32	0.35
Total primary supply ⁷	19.46	20.56	20.08	19.22	20.45	19.52	17.98	21.60	20.12	18.21
Product supplied										
by fuel										
Liquefied petroleum gases and other ⁸	2.46	2.88	2.90	2.80	3.32	3.34	3.22	3.76	3.80	3.61
Motor gasoline ⁹	9.18	9.35	8.97	8.26	8.33	7.35	6.28	8.15	6.84	5.65
of which: E85 ¹⁰	0.03	0.03	0.03	0.12	0.06	0.15	0.39	0.10	0.19	0.43
Jet fuel ¹¹	1.54	1.58	1.56	1.54	1.74	1.73	1.71	1.87	1.86	1.84
Distillate fuel oil ¹²	3.96	4.36	4.31	4.26	4.43	4.46	4.22	4.82	4.67	4.27
of which: Diesel	3.76	3.99	3.97	3.96	4.13	4.19	3.98	4.56	4.43	4.06
Residual fuel oil	0.26	0.30	0.25	0.23	0.31	0.27	0.26	0.30	0.28	0.27
Other ¹³	2.02	2.12	2.11	2.16	2.34	2.39	2.33	2.73	2.70	2.59
by sector										
Residential and commercial	0.90	0.98	0.89	0.78	0.92	0.80	0.68	0.84	0.74	0.64
Industrial ¹⁴	4.47	5.36	5.35	5.33	6.01	6.10	5.94	6.85	6.89	6.60
Transportation	14.04	14.51	14.11	13.37	13.78	12.84	11.53	14.18	12.69	11.11
Electric power ¹⁵	0.12	0.07	0.07	0.07	0.05	0.05	0.05	0.04	0.04	0.04
Unspecified sector ¹⁶	-0.30	-0.32	-0.31	-0.29	-0.28	-0.25	-0.19	-0.28	-0.23	-0.16
Total product supplied	19.42	20.59	20.11	19.26	20.47	19.54	18.01	21.63	20.14	18.24
Discrepancy ¹⁷	0.04	-0.03	-0.03	-0.03	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03

Table C4. Petroleum and other liquids supply and disposition (continued)
(million barrels per day, unless otherwise noted)

Supply and disposition	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Domestic refinery distillation capacity ¹⁸	18.0	19.0	19.0	19.2	19.0	19.0	19.3	19.0	19.0	19.3
Capacity utilization rate (percent) ¹⁹	91.1	79.2	87.7	93.8	77.0	88.9	87.5	88.8	92.5	86.9
Net import share of product supplied (percent) ..	23.7	28.3	18.6	3.6	33.5	11.6	-13.0	28.3	7.4	-8.5
Net expenditures for imported crude oil and petroleum products (billion 2015 dollars)	128	88	207	399	126	268	455	221	348	609

¹Includes lease condensate.

²Strategic petroleum reserve stock additions plus unaccounted for crude oil and crude oil stock withdrawals.

³Includes other hydrocarbons and alcohols.

⁴The volumetric amount by which total output is greater than input due to the processing of crude oil into products which, in total, have a lower specific gravity than the crude oil processed.

⁵Includes pyrolysis oils, biomass-derived Fischer-Tropsch liquids, biobutanol, and renewable feedstocks used for the on-site production of diesel and gasoline.

⁶Includes domestic sources of other blending components, other hydrocarbons, and ethers.

⁷Total crude supply, net product imports, refinery processing gain, product stock withdrawal, natural gas plant liquids, supply from renewable sources, liquids from gas, liquids from coal, and other supply.

⁸Includes ethane, natural gasoline, and refinery olefins.

⁹Includes ethanol and ethers blended into gasoline.

¹⁰E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

¹¹Includes only kerosene type.

¹²Includes distillate fuel oil from petroleum and biomass feedstocks.

¹³Includes kerosene, aviation gasoline, petrochemical feedstocks, lubricants, waxes, asphalt, road oil, still gas, special naphthas, petroleum coke, crude oil product supplied, methanol, and miscellaneous petroleum products.

¹⁴Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

¹⁵Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

¹⁶Represents consumption unattributed to the sectors above.

¹⁷Balancing item. Includes unaccounted for supply, losses, and gains.

¹⁸End-of-year operable capacity.

¹⁹Rate is calculated by dividing the gross annual input to atmospheric crude oil distillation units by their operable refining capacity in barrels per calendar day.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowprice.d041916a, ref2016.d032416a, and highprice.d041916a.

Table C5. Petroleum and other liquids prices
(2015 dollars per gallon, unless otherwise noted)

Sector and fuel	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Crude oil prices (2015 dollars per barrel)										
Brent spot	52	38	77	152	49	104	207	73	136	230
West Texas Intermediate spot	49	32	71	145	42	97	198	67	129	222
Average imported refiners acquisition cost ¹	46	30	69	142	40	95	191	66	126	213
Brent / West Texas Intermediate spread.....	3.7	6.1	5.4	7.1	6.6	6.9	8.9	6.0	7.1	7.6
Delivered sector product prices										
Residential										
Propane.....	1.55	1.47	1.84	2.66	1.55	2.04	3.07	1.77	2.33	3.15
Distillate fuel oil	2.66	2.05	3.08	5.00	2.35	3.82	6.42	2.99	4.65	7.00
Commercial										
Distillate fuel oil	2.34	1.68	2.71	4.63	1.90	3.36	5.96	2.53	4.19	6.54
Residual fuel oil.....	1.04	0.69	1.64	3.26	0.99	2.29	4.51	1.63	2.98	5.01
Residual fuel oil (2015 dollars per barrel).....	44	29	69	137	41	96	189	68	125	210
Industrial²										
Propane.....	1.12	1.04	1.42	2.27	1.12	1.63	2.69	1.35	1.93	2.77
Distillate fuel oil	2.34	1.68	2.71	4.62	1.90	3.36	5.96	2.53	4.19	6.54
Residual fuel oil.....	1.01	0.73	1.68	3.29	1.09	2.39	4.60	1.73	3.08	5.11
Residual fuel oil (2015 dollars per barrel).....	42	31	71	138	46	100	193	73	130	214
Transportation										
Propane.....	1.64	1.57	1.94	2.76	1.65	2.14	3.17	1.87	2.43	3.25
E85 ³	2.21	2.30	3.05	3.62	2.42	2.93	3.74	2.71	3.33	4.01
Ethanol wholesale price	2.22	2.74	2.77	2.78	2.11	2.28	2.55	2.29	2.60	2.93
Motor gasoline ⁴	2.52	1.94	2.74	4.28	2.04	3.19	5.17	2.53	3.81	5.61
Jet fuel ⁵	1.62	1.16	2.18	3.99	1.47	2.87	5.41	2.15	3.74	6.04
Diesel fuel (distillate fuel oil) ⁶	2.72	2.15	3.18	5.09	2.40	3.85	6.45	3.03	4.68	7.04
Residual fuel oil.....	1.21	0.73	1.75	3.23	0.84	2.25	4.23	1.63	2.87	4.67
Residual fuel oil (2015 dollars per barrel).....	51	31	73	136	35	94	178	69	121	196
Electric power⁷										
Distillate fuel oil	2.07	1.50	2.53	4.45	1.77	3.23	5.84	2.39	4.04	6.41
Residual fuel oil.....	1.53	1.12	2.06	3.68	1.40	2.70	4.92	2.00	3.36	5.38
Residual fuel oil (2015 dollars per barrel).....	64	47	87	154	59	114	207	84	141	226
Average prices, all sectors⁸										
Propane.....	1.36	1.27	1.65	2.46	1.35	1.83	2.84	1.56	2.12	2.91
Motor gasoline ⁴	2.52	1.94	2.74	4.28	2.04	3.19	5.17	2.53	3.81	5.61
Jet fuel ⁵	1.62	1.16	2.18	3.99	1.47	2.87	5.41	2.15	3.74	6.04
Distillate fuel oil	2.63	2.04	3.07	4.99	2.30	3.75	6.36	2.93	4.58	6.94
Residual fuel oil.....	1.26	0.75	1.76	3.29	0.94	2.30	4.35	1.66	2.93	4.78
Residual fuel oil (2015 dollars per barrel).....	53	32	74	138	40	97	183	70	123	201
Average	2.18	1.65	2.44	3.97	1.75	2.85	4.82	2.21	3.42	5.16

Table C5. Petroleum and other liquids prices (continued)
(nominal dollars per gallon, unless otherwise noted)

Sector and fuel	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Crude oil prices (nominal dollars per barrel)										
Brent spot	52	42	85	166	66	141	284	121	229	397
West Texas Intermediate spot	49	35	79	159	58	131	272	111	217	384
Average imported refiners acquisition cost ¹	46	33	76	156	55	128	263	109	212	369
Delivered sector product prices										
Residential										
Propane.....	1.55	1.62	2.03	2.92	2.11	2.76	4.22	2.94	3.93	5.44
Distillate fuel oil	2.66	2.26	3.40	5.49	3.20	5.16	8.83	4.97	7.83	12.09
Commercial										
Distillate fuel oil	2.34	1.85	2.99	5.08	2.58	4.54	8.20	4.21	7.04	11.30
Residual fuel oil.....	1.04	0.76	1.81	3.58	1.34	3.09	6.20	2.70	5.02	8.65
Industrial²										
Propane.....	1.12	1.15	1.57	2.49	1.53	2.20	3.69	2.24	3.25	4.78
Distillate fuel oil	2.34	1.85	2.99	5.08	2.59	4.54	8.20	4.21	7.04	11.30
Residual fuel oil.....	1.01	0.81	1.86	3.61	1.49	3.23	6.33	2.88	5.19	8.82
Transportation										
Propane.....	1.64	1.73	2.14	3.03	2.24	2.89	4.36	3.10	4.09	5.61
E85 ³	2.21	2.53	3.37	3.98	3.28	3.97	5.14	4.51	5.60	6.93
Ethanol wholesale price	2.22	3.02	3.06	3.05	2.86	3.09	3.50	3.80	4.38	5.06
Motor gasoline ⁴	2.52	2.14	3.02	4.70	2.77	4.32	7.11	4.20	6.40	9.68
Jet fuel ⁵	1.62	1.28	2.41	4.38	2.00	3.89	7.44	3.58	6.29	10.42
Diesel fuel (distillate fuel oil) ⁶	2.72	2.38	3.51	5.59	3.26	5.21	8.88	5.03	7.88	12.15
Residual fuel oil.....	1.21	0.80	1.93	3.55	1.14	3.04	5.82	2.71	4.83	8.06
Electric power⁷										
Distillate fuel oil	2.07	1.66	2.80	4.89	2.41	4.37	8.04	3.97	6.79	11.06
Residual fuel oil.....	1.53	1.23	2.28	4.04	1.90	3.66	6.77	3.32	5.65	9.30
Average prices, all sectors⁸										
Propane.....	1.36	1.40	1.82	2.70	1.83	2.48	3.91	2.60	3.56	5.03
Motor gasoline ⁴	2.52	2.14	3.02	4.70	2.77	4.32	7.11	4.20	6.40	9.68
Jet fuel ⁵	1.62	1.28	2.41	4.38	2.00	3.89	7.44	3.58	6.29	10.42
Distillate fuel oil	2.63	2.25	3.39	5.47	3.12	5.08	8.75	4.87	7.71	11.98
Residual fuel oil (nominal dollars per barrel)	53	35	81	152	54	131	251	116	207	347
Average	2.18	1.82	2.70	4.35	2.37	3.86	6.64	3.68	5.76	8.91

¹Weighted average price delivered to U.S. refiners.

²Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

³E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

⁴Sales weighted-average price for all grades. Includes Federal, State, and local taxes.

⁵Includes only kerosene type.

⁶Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes.

⁷Includes electricity-only and combined heat and power plants that have a regulatory status.

⁸Weighted averages of end-use fuel prices are derived from the prices in each sector and the corresponding sectoral consumption.

Note: Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowprice.d041916a, ref2016.d032416a, and highprice.d041916a.

Table C6. International petroleum and other liquids supply, disposition, and prices
(million barrels per day, unless otherwise noted)

Supply, disposition, and prices	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Crude oil spot prices										
(2015 dollars per barrel)										
Brent	52	38	77	152	49	104	207	73	136	230
West Texas Intermediate	49	32	71	145	42	97	198	67	129	222
(nominal dollars per barrel)										
Brent	52	42	85	166	66	141	284	121	229	397
West Texas Intermediate	49	35	79	159	58	131	272	111	217	384
Petroleum and other liquids consumption¹										
OECD										
United States (50 states)	19.42	20.59	20.11	19.26	20.47	19.54	18.01	21.63	20.14	18.24
United States territories	0.30	0.31	0.31	0.31	0.34	0.34	0.34	0.38	0.38	0.38
Canada	2.39	2.45	2.39	2.32	2.48	2.39	2.39	2.64	2.51	2.57
Mexico and Chile	2.30	2.48	2.38	2.27	2.61	2.50	2.44	3.05	2.87	2.84
OECD Europe ²	13.83	13.98	13.70	13.28	13.98	13.65	13.36	14.43	13.98	13.60
Japan	4.14	4.02	3.91	3.69	3.80	3.66	3.48	3.60	3.40	3.33
South Korea	2.38	2.50	2.41	2.25	2.54	2.44	2.32	2.67	2.55	2.49
Australia and New Zealand	1.28	1.37	1.35	1.32	1.43	1.41	1.40	1.55	1.53	1.55
Total OECD consumption	46.03	47.70	46.56	44.69	47.65	45.93	43.73	49.94	47.35	45.01
Non-OECD										
Russia	3.35	3.68	3.65	3.51	3.77	3.75	3.68	3.58	3.59	3.58
Other Europe and Eurasia ³	2.07	2.22	2.18	2.11	2.46	2.43	2.39	2.56	2.53	2.53
China	11.18	12.87	12.71	12.43	14.65	14.81	14.95	15.53	16.36	17.15
India	3.97	4.67	4.54	4.32	6.07	5.94	5.59	8.35	8.26	7.41
Other Asia ⁴	8.15	9.67	9.40	9.01	11.74	11.42	10.76	14.41	14.29	13.46
Middle East	8.29	10.31	9.96	9.76	11.42	11.28	11.47	13.21	13.23	14.09
Africa	3.86	4.64	4.54	4.40	5.62	5.50	5.43	7.03	6.93	6.99
Brazil	3.15	3.52	3.41	3.24	4.14	4.06	3.93	4.80	4.71	4.58
Other Central and South America	3.85	4.23	4.11	3.98	4.57	4.41	4.18	5.00	4.89	4.65
Total non-OECD consumption	47.87	55.82	54.49	52.77	64.43	63.60	62.38	74.45	74.79	74.44
Total consumption	93.90	103.51	101.05	97.46	112.08	109.52	106.11	124.39	122.14	119.44
Petroleum and other liquids production										
OPEC ⁵										
Middle East	27.76	32.44	30.87	27.42	36.70	34.29	29.33	41.63	39.38	31.71
North Africa	2.13	3.51	1.99	2.12	3.73	2.32	2.11	4.03	2.94	2.28
West Africa	4.21	4.51	4.35	4.08	5.04	4.58	3.53	6.21	5.07	3.57
South America	3.24	4.17	2.96	2.59	5.46	3.33	2.85	6.76	3.88	3.21
Total OPEC production	37.33	44.63	40.17	36.21	50.93	44.52	37.81	58.63	51.28	40.77
Non-OPEC										
OECD										
United States (50 states)	14.95	14.73	16.33	18.51	13.60	17.26	20.32	15.49	18.62	19.76
Canada	4.54	5.11	5.43	5.14	4.68	5.55	6.16	4.63	6.01	8.25
Mexico and Chile	2.64	2.54	2.46	2.75	2.69	2.58	3.35	3.11	3.24	5.06
OECD Europe ²	3.79	3.47	3.44	3.40	3.11	3.10	3.03	2.86	2.78	2.80
Japan and South Korea	0.22	0.17	0.20	0.16	0.19	0.21	0.17	0.20	0.22	0.18
Australia and New Zealand	0.51	0.67	0.66	0.75	0.60	0.61	1.08	0.56	0.76	1.53
Total OECD production	26.65	26.68	28.51	30.71	24.87	29.31	34.12	26.84	31.63	37.58
Non-OECD										
Russia	10.95	10.44	10.62	9.68	11.75	11.22	9.80	12.56	12.21	11.17
Other Europe and Eurasia ³	3.23	3.78	3.69	3.18	4.93	4.63	4.03	5.12	4.50	5.75
China	4.69	4.91	4.90	4.86	5.36	5.44	5.65	5.70	6.24	6.78
Other Asia ⁴	4.03	3.91	3.92	3.88	3.63	3.65	3.65	3.60	3.62	3.68
Middle East	1.14	1.04	1.02	1.02	0.84	0.83	0.83	0.70	0.69	0.70
Africa	2.33	2.42	2.48	2.46	2.46	2.73	2.56	2.56	2.83	2.75
Brazil	3.15	3.57	3.59	3.21	5.25	5.00	4.73	6.45	6.15	6.03
Other Central and South America	2.18	2.14	2.15	2.25	2.06	2.19	2.93	2.22	2.99	4.24
Total non-OECD production	31.70	32.20	32.37	30.55	36.28	35.69	34.18	38.92	39.23	41.09
Total petroleum and other liquids production	95.68	103.51	101.05	97.46	112.08	109.52	106.11	124.39	122.14	119.44
OPEC market share (percent)	39.0	43.1	39.8	37.2	45.4	40.7	35.6	47.1	42.0	34.1

Table C6. International petroleum and other liquids supply, disposition, and prices (continued)
(million barrels per day, unless otherwise noted)

Supply, disposition, and prices	2015	Projections								
		2020			2030			2040		
		Low oil price	Reference	High oil price	Low oil price	Reference	High oil price	Low oil price	Reference	High oil price
Selected world production subtotals:										
Crude oil and equivalents ⁶	80.13	86.11	82.77	78.52	93.24	89.12	83.45	103.39	99.74	92.92
Tight oil.....	5.34	4.19	5.44	7.73	4.17	6.96	10.17	5.55	10.35	12.84
Bitumen ⁷	2.32	2.99	3.08	3.08	2.88	3.18	3.68	2.99	3.31	4.80
Refinery processing gain ⁸	2.45	2.46	2.53	2.55	2.78	2.73	2.67	3.23	2.94	2.95
Natural gas plant liquids.....	10.37	11.74	12.32	12.87	12.67	13.24	14.34	13.82	13.88	15.69
Liquids from renewable sources ⁹	2.32	2.42	2.54	2.54	2.99	3.31	3.35	3.55	4.11	4.13
Liquids from coal ¹⁰	0.25	0.25	0.27	0.31	0.04	0.26	0.88	0.00	0.50	1.48
Liquids from natural gas ¹¹	0.29	0.31	0.32	0.37	0.11	0.57	1.10	0.12	0.65	1.92
Liquids from kerogen ¹²	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Crude oil production⁶										
OPEC ⁵										
Middle East.....	24.38	29.14	27.07	23.60	33.28	30.10	25.10	38.06	34.74	27.03
North Africa.....	1.78	2.95	1.61	1.63	3.03	1.82	1.46	3.18	2.20	1.46
West Africa.....	4.19	4.37	4.28	3.93	4.91	4.51	3.36	6.09	4.99	3.37
South America.....	3.05	3.88	2.75	2.38	5.11	3.09	2.60	6.42	3.64	2.96
Total OPEC production	33.40	40.34	35.72	31.54	46.33	39.52	32.51	53.75	45.57	34.83
Non-OPEC										
OECD										
United States (50 states).....	9.42	8.13	9.38	11.16	7.10	10.06	12.14	8.62	11.26	11.02
Canada.....	3.72	4.42	4.57	4.34	3.95	4.53	5.33	3.89	4.96	7.40
Mexico and Chile.....	2.31	2.19	2.16	2.46	2.35	2.29	3.07	2.77	2.96	4.78
OECD Europe ²	2.95	2.36	2.31	2.29	1.90	1.88	1.81	1.51	1.47	1.44
Japan and South Korea.....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Australia and New Zealand.....	0.39	0.53	0.53	0.62	0.46	0.49	0.96	0.41	0.64	1.39
Total OECD production	18.81	17.63	18.96	20.88	15.77	19.24	23.30	17.20	21.29	26.04
Non-OECD										
Russia.....	10.17	9.84	9.84	8.79	10.90	10.49	8.51	11.28	11.53	9.21
Other Europe and Eurasia ³	3.00	3.48	3.43	2.90	4.49	4.36	3.62	4.46	4.23	5.11
China.....	4.28	4.38	4.34	4.27	4.57	4.40	4.23	4.68	4.67	4.49
Other Asia ⁴	3.18	3.01	2.98	2.95	2.57	2.52	2.52	2.28	2.25	2.25
Middle East.....	1.11	0.99	1.00	0.99	0.80	0.81	0.81	0.67	0.67	0.67
Africa.....	1.94	1.94	2.01	1.99	2.15	2.25	2.02	2.26	2.34	2.05
Brazil.....	2.43	2.80	2.77	2.39	4.07	3.78	3.46	5.08	4.67	4.52
Other Central and South America.....	1.81	1.69	1.72	1.80	1.58	1.75	2.46	1.73	2.52	3.75
Total non-OECD production	27.92	28.15	28.09	26.10	31.14	30.36	27.64	32.44	32.87	32.05
Total crude oil production⁶	80.13	86.11	82.77	78.52	93.24	89.12	83.45	103.39	99.74	92.92
OPEC market share (percent)	41.7	46.8	43.2	40.2	49.7	44.3	39.0	52.0	45.7	37.5

¹Estimated consumption. Includes both OPEC and non-OPEC consumers in the regional breakdown.

²OECD Europe = Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

³Other Europe and Eurasia = Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kosovo, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malta, Moldova, Montenegro, Romania, Serbia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

⁴Other Asia = Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia (Kampuchea), Fiji, French Polynesia, Guam, Hong Kong, India (for production), Indonesia, Kiribati, Laos, Malaysia, Macau, Maldives, Mongolia, Myanmar (Burma), Nauru, Nepal, New Caledonia, Niue, North Korea, Pakistan, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Tonga, Vanuatu, and Vietnam.

⁵OPEC = Organization of the Petroleum Exporting Countries = Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

⁶Includes crude oil, lease condensate, tight oil (shale oil), extra-heavy oil, and bitumen (oil sands).

⁷Includes diluted and upgraded/synthetic bitumen (syncrude).

⁸The volumetric amount by which total output is greater than input due to the processing of crude oil into products which, in total, have a lower specific gravity than the crude oil processed.

⁹Includes liquids produced from energy crops.

¹⁰Includes liquids converted from coal via the Fischer-Tropsch coal-to-liquids process.

¹¹Includes liquids converted from natural gas via the Fischer-Tropsch natural-gas-to-liquids process.

¹²Includes liquids produced from kerogen (oil shale, not to be confused with tight oil (shale oil)).

OECD = Organization for Economic Cooperation and Development.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: Energy Information Administration (EIA), AEO2016 National Energy Modeling System runs lowprice.d041916a, ref2016.d032416a, and highprice.d041916a; and EIA, Generate World Oil Balance application.

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix D

Results from side cases

Table D1. Key results for Clean Power Plan cases

Capacity, generation, prices, consumption, and emissions	2015	2020					
		Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended
Net summer capacity (gigawatts)¹							
Capacity							
Electric power sector ²	1,040.8	1,053.0	1,053.2	1,054.4	1,052.6	1,054.8	1,048.5
Coal ³	281.4	211.7	211.7	212.1	211.8	212.3	205.9
Oil and natural gas steam ^{3,4}	91.4	90.3	90.3	91.2	90.5	91.0	90.9
Combined cycle.....	227.3	247.5	247.1	247.5	246.4	247.4	248.5
Combustion turbine/diesel.....	141.2	142.9	143.4	142.9	143.2	143.3	143.1
Nuclear power.....	99.8	99.1	99.1	99.1	99.1	99.1	99.1
Solar ⁵	13.8	28.0	28.1	28.0	28.1	28.1	27.5
Wind.....	74.4	120.4	120.4	120.4	120.4	120.4	120.4
Other renewable energy ⁶	89.0	90.3	90.3	90.3	90.3	90.3	90.3
Other ⁷	22.6	22.9	22.9	22.9	22.9	22.9	22.9
End-use sector ⁸	41.3	61.1	61.1	61.2	61.1	61.2	62.0
Total capacity.....	1,082.1	1,114.2	1,114.4	1,115.5	1,113.8	1,115.9	1,110.6
Capacity additions (gigawatts)⁹							
Electric power sector ²	--	101.1	101.0	101.3	101.0	101.3	102.4
Coal ³	--	0.5	0.5	0.5	0.5	0.5	0.5
Combined cycle.....	--	26.7	26.3	26.8	26.3	26.7	28.1
Combustion turbine/diesel.....	--	7.3	7.4	7.3	7.4	7.3	7.7
Nuclear power.....	--	4.4	4.4	4.4	4.4	4.4	4.4
Solar ⁵	--	14.2	14.4	14.2	14.4	14.4	13.8
Wind.....	--	46.1	46.1	46.1	46.1	46.1	46.1
Other renewable energy ⁶	--	1.7	1.7	1.7	1.7	1.7	1.7
Other ⁷	--	0.2	0.3	0.2	0.3	0.2	0.2
End-use sector ⁸	--	21.0	21.0	21.0	21.0	21.0	21.1
Total capacity additions.....	--	122.1	122.1	122.3	122.1	122.3	123.5
Capacity retirements (gigawatts)⁹							
Electric power sector ²	--	88.9	88.6	87.7	89.2	87.4	94.7
Coal ³	--	61.6	61.6	61.2	61.5	61.0	67.4
Oil and natural gas steam ^{3,4}	--	9.7	9.7	8.8	9.5	9.0	9.1
Combined cycle.....	--	6.5	6.5	6.6	7.2	6.6	6.9
Combustion turbine/diesel.....	--	5.5	5.3	5.6	5.4	5.2	5.8
Nuclear power.....	--	5.2	5.2	5.2	5.2	5.2	5.2
Renewable energy ¹⁰	--	0.4	0.4	0.4	0.4	0.4	0.4
Fuel cells.....	--	0.0	0.0	0.0	0.0	0.0	0.0
End-use sector ⁸	--	1.2	1.2	1.2	1.2	1.2	0.4
Total capacity retirements.....	--	90.1	89.9	89.0	90.5	88.6	95.1
Total net electricity generation by fuel (billion kilowatthours)							
Coal.....	1,355	1,388	1,389	1,389	1,389	1,388	1,366
Petroleum.....	26	15	15	15	15	15	15
Natural gas.....	1,348	1,201	1,199	1,199	1,199	1,201	1,220
Nuclear power.....	798	777	777	777	777	777	777
Solar ⁵	38	93	93	93	93	93	92
Wind.....	190	368	368	368	367	368	368
Other renewable energy ⁶	319	376	375	376	375	376	376
Other ¹¹	17	27	27	27	27	27	27
Total net electricity generation.....	4,090	4,244	4,243	4,244	4,243	4,245	4,240
Fuel prices to the electric power sector² (2015 dollars per million Btu)							
Natural gas.....	3.26	4.69	4.69	4.68	4.69	4.68	4.76
Steam coal.....	2.19	2.26	2.26	2.26	2.26	2.26	2.27
Electricity prices (2015 cents per kilowatthour)							
Residential.....	12.4	12.9	12.9	12.9	12.9	12.9	12.9
Commercial.....	10.5	10.7	10.7	10.7	10.7	10.7	10.8
Industrial.....	6.9	7.1	7.1	7.1	7.1	7.1	7.2
Transportation.....	10.1	11.3	11.3	11.3	11.3	11.3	11.3
All sectors average price.....	10.3	10.5	10.5	10.5	10.5	10.5	10.6

2030						2040					
Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended	Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended
1,094.2	1,139.1	1,107.1	1,138.9	1,088.9	1,107.9	1,239.6	1,252.2	1,259.0	1,251.4	1,242.6	1,250.4
180.3	186.6	185.6	188.2	179.4	174.9	172.8	186.6	178.9	188.2	172.3	152.7
54.5	66.0	52.7	62.8	53.4	52.1	52.8	63.3	50.0	60.7	49.8	49.6
294.5	259.0	280.1	258.6	290.9	294.9	345.4	303.5	331.4	302.0	340.5	352.9
137.0	137.1	139.9	136.2	138.2	135.1	144.6	147.9	145.5	146.8	146.3	141.5
99.1	99.1	99.1	99.1	99.1	99.1	99.1	99.1	99.1	99.1	99.1	99.1
70.1	109.6	90.2	112.2	69.0	90.2	158.1	164.0	189.0	166.9	166.9	184.5
142.0	164.6	142.9	164.6	142.1	144.6	145.8	167.2	144.3	167.2	146.9	149.4
93.1	93.7	92.9	93.6	93.1	93.3	95.5	95.6	95.4	95.5	95.4	95.7
23.7	23.5	23.6	23.5	23.6	23.6	25.5	25.1	25.4	25.1	25.4	25.0
93.9	94.0	94.0	93.9	95.0	94.6	134.5	135.0	134.3	135.0	136.6	136.3
1,188.1	1,233.1	1,201.0	1,232.8	1,184.0	1,202.5	1,374.1	1,387.2	1,393.2	1,386.4	1,379.2	1,386.6
227.4	249.2	234.5	252.4	223.9	252.9	388.6	367.7	402.5	369.6	393.8	432.4
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
84.9	44.3	70.2	44.6	82.4	86.1	138.6	89.8	123.6	89.1	133.6	150.4
8.0	8.0	9.1	8.2	8.0	9.5	19.5	20.3	19.2	20.3	19.9	21.6
4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
56.4	95.8	76.4	98.5	55.3	76.5	144.3	150.3	175.2	153.2	153.1	170.7
67.7	90.3	68.6	90.3	67.8	70.3	71.5	92.9	70.1	92.9	72.7	75.2
4.5	5.0	4.3	5.0	4.5	4.7	6.9	7.0	6.8	6.9	6.8	7.1
1.0	0.9	0.9	0.9	0.9	1.0	2.9	2.5	2.8	2.4	2.7	2.4
53.8	53.9	53.8	53.8	54.9	53.7	94.3	94.9	94.1	94.9	96.5	95.3
281.1	303.1	288.3	306.2	278.8	306.5	482.9	462.6	496.6	464.6	490.2	527.7
174.0	151.0	168.3	154.4	175.8	185.9	189.8	156.3	184.4	159.1	192.0	222.9
92.1	85.8	86.7	84.2	92.9	97.4	99.6	85.8	93.5	84.2	100.1	119.7
46.4	34.9	48.2	38.1	47.5	48.8	48.1	37.6	50.9	40.2	51.1	51.3
17.7	12.5	17.4	13.3	18.8	18.5	20.5	13.6	19.5	14.4	20.4	24.9
12.2	12.2	10.4	13.2	11.0	15.6	16.0	13.7	14.8	14.6	14.8	21.3
5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2	1.2	1.2	1.2	1.2	0.4	1.2	1.2	1.2	1.2	1.2	0.4
175.2	152.2	169.5	155.6	177.0	186.2	191.0	157.6	185.6	160.3	193.2	223.2
972	995	1,029	997	979	987	919	1,080	980	1,081	931	653
11	11	12	11	11	11	9	10	10	10	9	8
1,702	1,531	1,607	1,524	1,680	1,650	1,942	1,723	1,829	1,712	1,896	2,097
789	789	789	789	789	789	789	789	789	789	789	789
227	302	267	306	226	266	477	482	546	491	498	538
457	528	459	528	457	466	473	541	467	540	477	487
405	407	404	407	405	405	424	422	423	421	422	427
27	27	27	27	27	27	27	27	27	27	27	27
4,590	4,591	4,594	4,591	4,574	4,601	5,060	5,074	5,071	5,071	5,050	5,025
5.57	5.32	5.42	5.31	5.57	5.33	5.36	5.07	5.14	5.07	5.35	5.58
2.26	2.29	2.27	2.29	2.28	2.26	2.38	2.46	2.37	2.46	2.40	2.26
13.4	13.5	13.4	13.4	13.6	13.3	13.0	13.0	12.9	13.0	13.1	13.4
11.0	11.0	11.0	11.0	11.2	10.9	10.5	10.5	10.4	10.5	10.6	10.8
7.5	7.6	7.5	7.5	7.7	7.4	7.2	7.2	7.2	7.2	7.3	7.5
12.7	12.7	12.7	12.6	13.0	12.6	12.1	12.0	12.0	12.0	12.2	12.5
10.9	10.9	10.9	10.9	11.1	10.8	10.5	10.5	10.4	10.4	10.6	10.8

Table D1. Key results for Clean Power Plan cases (continued)

Capacity, generation, prices, consumption, and emissions	2015	2020					
		Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended
Energy consumption (quadrillion Btu)							
Residential							
Petroleum and other liquids ¹²	0.93	0.86	0.86	0.86	0.86	0.86	0.86
Natural gas	4.77	4.87	4.87	4.87	4.87	4.87	4.86
Renewable energy ¹³	0.44	0.42	0.42	0.42	0.42	0.42	0.42
Electricity	4.78	4.76	4.76	4.76	4.76	4.76	4.76
Total residential	10.92	10.90	10.90	10.90	10.90	10.90	10.89
Nonmarketed residential renewable energy ¹⁴	0.11	0.35	0.35	0.35	0.35	0.35	0.35
Commercial							
Petroleum and other liquids ¹⁵	0.66	0.70	0.70	0.70	0.70	0.70	0.70
Natural gas	3.32	3.45	3.45	3.45	3.45	3.45	3.45
Coal	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Renewable energy ¹⁶	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Electricity	4.64	4.69	4.69	4.69	4.69	4.69	4.68
Total commercial	8.81	9.03	9.03	9.03	9.03	9.03	9.03
Nonmarketed commercial renewable energy ¹⁴	0.16	0.18	0.18	0.18	0.18	0.18	0.18
Industrial⁸							
Petroleum and other liquids ¹⁷	8.07	9.40	9.40	9.40	9.39	9.40	9.39
Natural gas	9.38	10.57	10.57	10.57	10.57	10.57	10.56
Coal	1.34	1.23	1.23	1.23	1.23	1.23	1.22
Renewable energy ¹⁸	2.26	2.30	2.30	2.30	2.30	2.30	2.30
Electricity	3.27	3.61	3.61	3.61	3.61	3.61	3.61
Total industrial	24.33	27.11	27.11	27.10	27.10	27.11	27.08
Transportation							
Petroleum and other liquids ¹⁹	27.14	27.32	27.32	27.32	27.32	27.32	27.31
Pipeline fuel natural gas	0.89	0.83	0.83	0.83	0.83	0.83	0.83
Compressed / liquefied natural gas	0.07	0.08	0.08	0.08	0.08	0.08	0.08
Liquid hydrogen	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Electricity	0.03	0.05	0.05	0.05	0.05	0.05	0.05
Total transportation	28.13	28.29	28.29	28.29	28.29	28.29	28.28
Unspecified sector ²⁰	-0.58	-0.58	-0.58	-0.58	-0.58	-0.58	-0.58
Electric power²							
Petroleum and other liquids ²¹	0.26	0.15	0.15	0.15	0.15	0.15	0.15
Natural gas	9.89	8.50	8.49	8.49	8.49	8.50	8.59
Steam coal	14.08	14.34	14.36	14.36	14.37	14.35	14.09
Nuclear / uranium ²²	8.34	8.12	8.12	8.12	8.12	8.12	8.12
Renewable energy ²³	4.86	7.37	7.34	7.37	7.36	7.37	7.36
Non-biogenic municipal waste	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Net electricity imports	0.19	0.19	0.20	0.20	0.20	0.19	0.20
Total electric power	37.85	38.90	38.89	38.91	38.91	38.91	38.73
Total marketed energy consumption							
Petroleum and other liquids	36.49	37.85	37.85	37.85	37.85	37.85	37.83
Natural gas	28.31	28.30	28.29	28.29	28.29	28.30	28.38
Coal	15.48	15.62	15.64	15.64	15.65	15.63	15.36
Nuclear / uranium ²²	8.34	8.12	8.12	8.12	8.12	8.12	8.12
Renewable energy ²⁴	7.71	10.22	10.20	10.23	10.21	10.23	10.22
Other ²⁵	0.42	0.43	0.43	0.43	0.43	0.43	0.43
Total marketed energy consumption	96.74	100.55	100.54	100.56	100.55	100.55	100.34

2030						2040					
Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended	Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended
0.72	0.72	0.72	0.72	0.72	0.72	0.61	0.61	0.61	0.61	0.61	0.61
4.80	4.81	4.81	4.81	4.80	4.81	4.73	4.75	4.74	4.75	4.73	4.72
0.39	0.39	0.39	0.39	0.39	0.39	0.37	0.37	0.37	0.37	0.37	0.37
4.83	4.82	4.83	4.83	4.81	4.84	5.20	5.19	5.21	5.20	5.18	5.16
10.74	10.74	10.75	10.75	10.72	10.76	10.91	10.92	10.93	10.93	10.89	10.86
0.63	0.63	0.63	0.63	0.64	0.63	0.94	0.94	0.93	0.94	0.95	0.94
0.68	0.68	0.68	0.68	0.68	0.68	0.67	0.67	0.67	0.67	0.67	0.67
3.53	3.55	3.55	3.55	3.54	3.56	3.81	3.84	3.83	3.84	3.83	3.81
0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
5.09	5.08	5.08	5.08	5.06	5.09	5.62	5.62	5.63	5.62	5.60	5.58
9.49	9.50	9.51	9.51	9.48	9.53	10.28	10.31	10.32	10.32	10.28	10.25
0.29	0.29	0.29	0.29	0.29	0.29	0.47	0.47	0.47	0.47	0.48	0.47
10.55	10.61	10.59	10.62	10.56	10.57	11.82	11.96	11.90	11.97	11.85	11.68
11.72	11.82	11.77	11.81	11.74	11.74	12.89	13.02	12.96	13.03	12.93	12.79
1.35	1.34	1.35	1.33	1.40	1.32	1.34	1.33	1.35	1.33	1.38	1.31
2.47	2.47	2.47	2.47	2.47	2.47	2.63	2.64	2.63	2.64	2.63	2.61
3.98	3.99	3.99	3.99	3.97	3.99	4.26	4.30	4.28	4.30	4.25	4.21
30.07	30.23	30.18	30.23	30.13	30.11	32.94	33.26	33.13	33.28	33.04	32.60
25.01	25.03	25.04	25.03	25.01	25.01	24.75	24.81	24.77	24.81	24.77	24.66
0.94	0.93	0.93	0.92	0.94	0.93	1.07	1.05	1.05	1.05	1.07	1.08
0.17	0.17	0.17	0.17	0.17	0.17	0.59	0.61	0.61	0.61	0.59	0.59
0.04	0.04	0.04	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.06
0.11	0.11	0.11	0.11	0.11	0.11	0.15	0.15	0.15	0.15	0.15	0.15
26.28	26.28	26.29	26.28	26.28	26.27	26.63	26.69	26.65	26.70	26.64	26.54
-0.46	-0.46	-0.46	-0.46	-0.46	-0.46	-0.42	-0.42	-0.42	-0.42	-0.42	-0.41
0.11	0.11	0.11	0.11	0.11	0.11	0.09	0.09	0.09	0.09	0.09	0.07
11.34	10.52	10.76	10.46	11.18	10.89	12.31	11.20	11.60	11.12	11.98	13.27
9.92	10.12	10.56	10.14	9.99	10.07	9.36	11.03	10.06	11.04	9.48	6.60
8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25
9.41	10.74	9.81	10.79	9.39	9.85	11.67	12.25	12.29	12.34	11.86	12.36
0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
0.17	0.17	0.17	0.17	0.17	0.17	0.15	0.15	0.15	0.15	0.15	0.15
39.42	40.13	39.89	40.15	39.31	39.56	42.04	43.19	42.65	43.20	42.03	40.93
36.62	36.69	36.69	36.70	36.63	36.64	37.52	37.73	37.63	37.73	37.56	37.28
32.51	31.79	31.99	31.73	32.37	32.10	35.39	34.47	34.79	34.41	35.12	36.25
11.32	11.51	11.97	11.53	11.44	11.45	10.75	12.41	11.46	12.42	10.91	7.97
8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25
12.41	13.74	12.81	13.79	12.39	12.85	14.80	15.40	15.42	15.48	14.99	15.47
0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43	0.43	0.43
101.54	102.42	102.14	102.44	101.51	101.73	107.15	108.69	107.98	108.73	107.27	105.65

Table D1. Key results for Clean Power Plan cases (continued)

Capacity, generation, prices, consumption, and emissions	2015	2020					
		Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended
Carbon dioxide emissions (million metric tons)							
by sector							
Residential	1,028	981	982	982	982	981	974
Commercial	918	893	893	893	893	893	885
Industrial ⁸	1,472	1,558	1,559	1,558	1,559	1,558	1,551
Transportation	1,855	1,857	1,858	1,857	1,857	1,857	1,857
Total carbon dioxide emissions	5,273	5,289	5,291	5,290	5,291	5,290	5,267
Electric power sector							
Petroleum	20	11	11	11	11	11	11
Natural gas	524	451	450	450	450	451	456
Coal	1,340	1,360	1,362	1,362	1,363	1,361	1,336
Other ²⁶	6	6	6	6	6	6	6
Total electric power sector	1,891	1,829	1,830	1,830	1,831	1,829	1,809

¹Net summer capacity is the steady hourly output that generating equipment is expected to supply to system load (exclusive of auxiliary power) as demonstrated by tests during summer peak demand.

²Includes electricity-only and combined heat and power plants that have a regulatory status.

³Total coal and oil and natural gas steam capacity account for the conversion of coal capacity to gas steam capacity but the conversions are not included explicitly as additions or retirements.

⁴Includes oil-, gas-, and dual-fired capacity.

⁵Does not include off-grid photovoltaics.

⁶Includes conventional hydroelectric, geothermal, wood, wood waste, municipal waste, landfill gas, and other biomass. Facilities co-firing biomass and coal are classified as coal.

⁷Includes pumped storage, fuel cells, and distributed generation.

⁸Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

⁹Cumulative after December 31, 2015.

¹⁰Includes conventional hydroelectric, geothermal, wood, wood waste, municipal waste, landfill gas, other biomass, solar, and wind power. Facilities co-firing biomass and coal are classified as coal.

¹¹Includes pumped storage, non-biogenic municipal waste, refinery gas, still gas, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

¹²Includes propane, kerosene, and distillate fuel oil.

¹³Includes wood used for residential heating. Excludes nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

¹⁴Includes selected renewable energy consumption data for which the energy is not bought or sold, either directly or indirectly as an input to marketed energy.

¹⁵Includes propane, motor gasoline (including ethanol and ethers), kerosene, distillate fuel oil, and residual fuel oil.

¹⁶Includes commercial sector consumption of wood and wood waste, landfill gas, municipal waste, and other biomass for combined heat and power. Excludes nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

¹⁷Includes ethane, propane, butane, isobutane, natural gasoline, refinery olefins, motor gasoline (including ethanol and ethers), distillate fuel oil, residual fuel oil, petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

¹⁸Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources, and all biomass input to liquid fuel conversion processes net of the liquid fuel produced.

¹⁹Includes propane, motor gasoline (including ethanol and ethers), jet fuel, distillate fuel oil, residual fuel oil, lubricants, and aviation gasoline.

²⁰Represents consumption unattributed to the sectors above.

²¹Includes distillate fuel oil and residual fuel oil.

²²These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

²³Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes net electricity imports.

²⁴Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources, and all biomass input to liquid fuel conversion processes net of the liquid fuel produced. Excludes net electricity imports and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

²⁵Includes non-biogenic municipal waste, liquid hydrogen, and net electricity imports.

²⁶Includes emissions from geothermal power and non-biogenic emissions from municipal waste.

CPP = Clean Power Plan.

Btu = British thermal unit.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Source: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System, runs ref2016.d032416a, ref_rate.d032416A, ref_trade.d032416a, ref_hybrid.d032416a, ref_allow_gen.d032416a, and ref_extend.d050416a.

2030						2040					
Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended	Reference	CPP Rate	CPP Interregional Trading	CPP Hybrid	CPP Allocation to Generators	CPP Extended
841	833	850	832	840	838	821	855	831	854	820	750
807	799	817	799	806	805	826	864	837	863	825	749
1,587	1,586	1,599	1,585	1,593	1,583	1,660	1,700	1,674	1,700	1,665	1,586
1,726	1,726	1,728	1,726	1,726	1,726	1,737	1,742	1,738	1,742	1,738	1,728
4,961	4,944	4,994	4,943	4,966	4,952	5,044	5,162	5,080	5,159	5,047	4,813
8	8	8	8	8	8	6	7	7	7	6	6
602	558	571	555	593	578	653	594	615	590	636	704
943	962	1,000	965	949	958	885	1,045	949	1,045	897	623
6	6	6	6	6	6	6	6	6	6	6	6
1,559	1,535	1,585	1,534	1,557	1,550	1,551	1,652	1,578	1,649	1,545	1,339

Table D2. Key transportation results for the Phase 2 Standards case

Key indicators, consumption, and emissions	2015	2020		2030		2040	
		Reference	Phase 2 Standards	Reference	Phase 2 Standards	Reference	Phase 2 Standards
Average fuel efficiency of new trucks (miles per gallon)							
Light medium							
Diesel	14.3	15.5	15.6	15.6	19.0	15.7	19.2
Motor gasoline	10.4	10.8	11.5	10.8	14.3	10.9	14.7
Propane	10.0	10.3	12.3	10.9	16.2	11.0	16.3
Compressed / liquefied natural gas	9.3	9.9	11.5	10.6	15.0	10.6	14.8
Light medium average	13.4	14.4	14.7	14.5	18.0	14.5	18.3
Medium							
Diesel	8.9	9.2	10.0	9.2	12.9	9.2	13.1
Motor gasoline	6.4	6.5	7.3	6.6	9.1	6.7	9.3
Propane	6.6	6.7	6.9	7.0	8.6	7.0	8.8
Compressed / liquefied natural gas	6.5	6.6	7.2	6.6	9.1	6.7	9.3
Medium average	8.3	8.5	9.3	8.6	12.0	8.7	12.2
Heavy							
Diesel	6.3	6.8	7.2	6.9	8.8	7.0	9.1
Motor gasoline	5.7	5.9	6.5	5.9	7.8	6.1	8.0
Propane	5.2	5.4	5.5	5.5	6.7	5.8	6.9
Compressed / liquefied natural gas	5.9	6.3	6.6	6.4	8.0	6.4	8.0
Heavy average	6.3	6.8	7.2	6.9	8.8	6.9	9.0
Average new truck fuel efficiency	7.1	7.7	8.2	7.9	10.3	8.0	10.6
New truck sales (thousands)							
Light medium							
Diesel	136	148	148	157	157	185	186
Motor gasoline	52	54	54	54	54	63	63
Propane	0	0	0	0	0	1	1
Compressed / liquefied natural gas	0	0	0	1	1	5	4
Light medium subtotal	188	202	202	212	212	253	253
Medium							
Diesel	133	165	165	181	181	200	201
Motor gasoline	51	60	60	62	62	67	67
Propane	0	0	0	1	0	2	2
Compressed / liquefied natural gas	0	1	1	1	1	1	1
Medium subtotal	184	225	225	244	244	269	270
Heavy							
Diesel	261	242	243	226	229	219	245
Motor gasoline	11	10	10	10	10	10	11
Propane	0	0	0	0	0	1	1
Compressed / liquefied natural gas	2	2	2	4	2	35	10
Heavy subtotal	275	254	255	241	241	265	266
Total new truck sales	647	681	682	697	698	787	790
Freight truck stock (millions)							
Light medium	3.17	3.91	3.91	5.02	5.02	5.83	5.84
Medium	3.19	3.68	3.68	4.68	4.68	5.46	5.47
Heavy	4.58	5.19	5.19	5.60	5.60	5.91	5.92
Total freight truck stock	10.93	12.77	12.77	15.29	15.30	17.20	17.22
Freight truck vehicle miles traveled (billion miles)							
Light medium	49.4	52.7	52.7	64.2	64.0	78.9	78.6
Medium	47.8	54.3	54.3	75.2	75.1	91.3	91.0
Heavy	182.6	197.2	197.3	209.5	209.1	236.6	235.6
Total freight truck vehicle miles traveled	279.8	304.2	304.4	348.9	348.2	406.8	405.1
Freight truck fuel efficiency (miles per gallon)							
Light medium	12.3	12.9	12.9	13.8	15.3	14.1	17.2
Medium	7.8	8.1	8.2	8.4	10.1	8.5	11.3
Heavy	6.0	6.3	6.4	6.7	7.7	6.8	8.6
Total freight truck fuel efficiency	6.9	7.3	7.4	7.8	9.0	8.0	10.2
Freight truck fuel consumption (quadrillion Btu)							
Light medium	0.54	0.55	0.55	0.63	0.56	0.75	0.62
Medium	0.82	0.90	0.88	1.21	1.00	1.46	1.08
Heavy	4.20	4.31	4.24	4.32	3.74	4.78	3.77
Total freight truck fuel consumption	5.57	5.76	5.67	6.16	5.30	6.98	5.46

Table D2. Key transportation results for the Phase 2 Standards case (continued)

Key indicators, consumption, and emissions	2015	2020		2030		2040	
		Reference	Phase 2 Standards	Reference	Phase 2 Standards	Reference	Phase 2 Standards
Fuel consumption (quadrillion Btu)							
Transportation sector	28.13	28.29	28.21	26.28	25.43	26.63	25.08
Propane.....	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Motor gasoline	17.01	16.79	16.79	13.62	13.55	12.55	12.40
of which: ethanol	1.18	1.19	1.19	1.12	1.12	1.24	1.23
Jet fuel ¹	2.84	2.99	2.99	3.32	3.32	3.56	3.56
Distillate fuel oil ²	6.67	6.99	6.91	7.49	6.73	8.01	6.92
Other petroleum ³	0.60	0.53	0.53	0.58	0.58	0.62	0.62
Petroleum and other liquids subtotal	27.14	27.32	27.24	25.01	24.18	24.75	23.52
Pipeline fuel natural gas	0.89	0.83	0.83	0.94	0.94	1.07	1.03
Compressed / liquefied natural gas	0.07	0.08	0.08	0.17	0.15	0.59	0.31
Liquid hydrogen.....	0.00	0.01	0.01	0.04	0.04	0.06	0.06
Electricity	0.03	0.05	0.05	0.11	0.11	0.15	0.15
Total energy consumption	96.7	100.5	100.5	101.5	100.5	107.1	105.2
Petroleum and other liquids.....	36.5	37.8	37.8	36.6	35.6	37.5	36.0
Natural gas	28.3	28.3	28.2	32.5	32.4	35.4	34.9
Coal	15.5	15.6	15.8	11.3	11.4	10.7	10.8
Nuclear / uranium ⁴	8.3	8.1	8.1	8.2	8.2	8.2	8.2
Renewable energy ⁵	7.7	10.2	10.1	12.4	12.4	14.8	14.8
Other ⁶	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Carbon dioxide emissions (million metric tons)							
Transportation sector	1,851	1,851	1,845	1,714	1,655	1,721	1,618
Petroleum ⁷	1,800	1,802	1,796	1,652	1,594	1,628	1,542
Natural gas ⁸	51	49	49	62	61	93	76
Total carbon dioxide emissions	5,273	5,289	5,295	4,961	4,894	5,044	4,929
Petroleum ⁷	2,309	2,332	2,325	2,191	2,127	2,181	2,085
Natural gas	1,482	1,466	1,463	1,685	1,677	1,835	1,809
Coal.....	1,476	1,485	1,501	1,079	1,083	1,021	1,028
Other ⁹	6	6	6	6	6	6	6

¹Includes only kerosene type.

²Diesel fuel for on- and off- road use.

³Includes residual fuel oil, aviation gasoline and lubricants.

⁴These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.

⁵Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, solar photovoltaic, and solar thermal sources, and all biomass input to liquid fuel conversion processes net of the liquid fuel produced. Excludes ethanol, net electricity imports, and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

⁶Includes non-biogenic municipal waste, liquid hydrogen, and net electricity imports.

⁷This includes carbon dioxide from international bunker fuels, both civilian and military, which are excluded from the accounting of carbon dioxide emissions under the United Nations convention. From 1990 through 2015, international bunker fuels accounted for 90 to 126 million metric tons annually.

⁸Includes emissions from pipeline fuel natural gas and from natural gas used as fuel in motor vehicles, trains, and ships.

⁹Includes emissions from geothermal power and non-biogenic emissions from municipal waste.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Source: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs ref2016.d032416a, and phaseii.d041316a.

Table D3. Key results for extended policies case

Consumption, emissions, electricity generating capacity and generation, and prices	2015	2020		2030		2040	
		Reference	Extended Policies	Reference	Extended Policies	Reference	Extended Policies
Energy consumption (quadrillion Btu)							
Residential							
Liquid fuels and other petroleum ¹	0.93	0.86	0.86	0.72	0.70	0.61	0.59
Natural gas.....	4.77	4.87	4.85	4.80	4.63	4.73	4.43
Renewable energy ²	0.44	0.42	0.41	0.39	0.39	0.37	0.36
Electricity.....	4.78	4.76	4.73	4.83	4.45	5.20	4.60
Total residential.....	10.92	10.90	10.86	10.74	10.17	10.91	9.98
Commercial							
Liquid fuels and other petroleum ³	0.66	0.70	0.70	0.68	0.68	0.67	0.67
Natural gas.....	3.32	3.45	3.44	3.53	3.56	3.81	3.79
Coal.....	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Renewable energy ⁴	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Electricity.....	4.64	4.69	4.68	5.09	4.98	5.62	5.42
Total commercial.....	8.81	9.03	9.01	9.49	9.41	10.28	10.07
Industrial⁵							
Liquid fuels and other petroleum ⁶	8.07	9.40	9.37	10.55	10.42	11.82	11.42
Natural gas.....	9.38	10.57	10.57	11.72	11.90	12.89	13.06
Coal.....	1.34	1.23	1.21	1.35	1.36	1.34	1.33
Renewable energy ⁷	2.26	2.30	2.30	2.47	2.48	2.63	2.60
Electricity.....	3.27	3.61	3.60	3.98	3.99	4.26	4.22
Total industrial.....	24.33	27.11	27.04	30.07	30.15	32.94	32.63
Transportation							
Liquid fuels and other petroleum ⁸	27.14	27.32	27.23	25.01	24.04	24.75	22.56
Pipeline fuel natural gas.....	0.89	0.83	0.84	0.94	0.91	1.07	1.01
Compressed / liquefied natural gas.....	0.07	0.08	0.08	0.17	0.14	0.59	0.32
Liquid hydrogen.....	0.00	0.01	0.01	0.04	0.04	0.06	0.06
Electricity.....	0.03	0.05	0.05	0.11	0.12	0.15	0.22
Total transportation.....	28.13	28.29	28.20	26.28	25.26	26.63	24.16
Unspecified sector⁹.....	-0.58	-0.58	-0.58	-0.46	-0.42	-0.42	-0.34
Electric power¹⁰							
Distillate and residual fuel oil.....	0.26	0.15	0.15	0.11	0.11	0.09	0.08
Natural gas.....	9.89	8.50	8.86	11.34	9.77	12.31	10.75
Steam coal.....	14.08	14.34	14.27	9.92	10.62	9.36	7.88
Nuclear / uranium ¹¹	8.34	8.12	8.12	8.25	8.25	8.25	8.25
Renewable energy ¹²	4.86	7.37	6.82	9.41	9.78	11.67	13.32
Non-biogenic municipal waste.....	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Net electricity imports.....	0.19	0.19	0.20	0.17	0.17	0.15	0.15
Total electric power.....	37.85	38.90	38.64	39.42	38.92	42.04	40.64
Total energy consumption							
Liquid fuels and other petroleum.....	36.49	37.85	37.73	36.62	35.54	37.52	34.97
Natural gas.....	28.31	28.30	28.64	32.51	30.91	35.39	33.35
Steam coal.....	15.48	15.62	15.54	11.32	12.03	10.75	9.26
Nuclear / uranium ¹¹	8.34	8.12	8.12	8.25	8.25	8.25	8.25
Renewable energy ¹³	7.71	10.22	9.67	12.41	12.78	14.80	16.42
Other ¹⁴	0.42	0.43	0.43	0.44	0.44	0.43	0.43
Total energy consumption.....	96.74	100.55	100.13	101.54	99.95	107.15	102.67
Carbon dioxide emissions (million metric tons)							
by sector							
Residential.....	317	317	316	303	293	292	275
Commercial.....	228	238	238	241	242	254	253
Industrial ⁵	986	1,054	1,052	1,144	1,145	1,226	1,210
Transportation.....	1,851	1,851	1,845	1,714	1,643	1,721	1,557
Electric power ¹⁰	1,891	1,829	1,841	1,559	1,542	1,551	1,327
by fuel							
Petroleum ¹⁵	2,309	2,332	2,325	2,191	2,115	2,181	2,011
Natural gas.....	1,482	1,466	1,484	1,685	1,599	1,835	1,725
Coal.....	1,476	1,485	1,477	1,079	1,146	1,021	879
Other ¹⁶	6	6	6	6	6	6	6
Total carbon dioxide emissions.....	5,273	5,289	5,292	4,961	4,867	5,044	4,623

Table D3. Key results for extended policies case (continued)

Consumption, emissions, electricity generating capacity and generation, and prices	2015	2020		2030		2040	
		Reference	Extended Policies	Reference	Extended Policies	Reference	Extended Policies
Electricity generating capacity (gigawatts)	1,082.1	1,114.2	1,093.9	1,188.1	1,207.0	1,374.1	1,410.3
Electric power sector ¹⁰	1,040.8	1,053.0	1,029.1	1,094.2	1,069.4	1,239.6	1,188.6
Coal	281.4	211.7	206.0	180.3	183.2	172.8	166.6
Oil and natural gas steam	91.4	90.3	91.9	54.5	47.7	52.8	39.2
Combined-cycle	227.3	247.5	246.4	294.5	260.0	345.4	280.1
Combustion turbine / diesel	141.2	142.9	141.8	137.0	127.5	144.6	121.5
Nuclear / uranium	99.8	99.1	99.1	99.1	99.1	99.1	99.1
Pumped storage	22.6	22.6	22.6	22.6	22.6	22.6	22.6
Renewable sources	177.1	238.7	221.1	305.2	328.8	399.4	458.2
of which: Solar	13.8	28.0	31.2	70.1	101.3	158.1	181.1
of which: Wind	74.4	120.4	99.9	142.0	134.5	145.8	181.2
Distributed generation	0.0	0.2	0.2	1.0	0.4	2.9	1.2
Residential and commercial sectors	15.2	33.8	37.1	62.0	104.0	98.2	182.6
of which: Natural gas	1.8	2.2	2.5	3.6	4.1	6.0	6.8
of which: Solar photovoltaic	11.2	28.7	28.8	55.1	84.9	88.3	149.5
of which: Wind	1.6	2.3	5.1	2.6	14.3	3.2	25.7
Industrial sector ⁵	26.1	27.3	27.8	31.8	33.6	36.3	39.1
of which: Natural gas	14.7	15.2	15.7	19.2	20.9	23.5	26.2
Cumulative capacity additions (gigawatts) ¹⁷	--	122.1	108.3	281.1	311.7	482.9	557.7
Cumulative capacity retirements (gigawatts) ¹⁷	--	90.1	96.6	175.2	186.9	191.0	229.5
Generation by fuel (billion kilowatthours)	4,090	4,244	4,234	4,590	4,511	5,060	4,943
Electric power sector ¹⁰	3,915	4,021	4,003	4,294	4,144	4,673	4,418
Coal	1,343	1,376	1,371	959	1,027	905	764
Petroleum	24	14	14	10	10	8	7
Natural gas	1,250	1,090	1,137	1,558	1,304	1,757	1,474
Nuclear / uranium	798	777	777	789	789	789	789
Pumped storage / other	3	3	3	3	3	3	3
Renewable sources	497	761	700	973	1,011	1,210	1,381
of which: Solar	22	52	59	148	213	350	400
of which: Wind	188	365	296	453	428	468	587
Distributed generation	0	0	0	1	0	2	1
Residential and commercial sectors	35	64	70	113	175	180	303
of which: Natural gas	13	16	18	27	30	44	49
of which: Solar photovoltaic	15	40	40	79	121	127	215
of which: Wind	2	3	7	3	19	4	34
Industrial sector ⁵	140	159	161	183	192	207	222
of which: Natural gas	86	96	98	116	125	139	154
Delivered natural gas prices (2015 dollars per thousand cubic feet)							
Residential	10.40	11.08	11.37	12.41	12.12	12.74	12.75
Commercial	7.92	9.58	9.86	10.72	10.28	10.73	10.47
Industrial ⁵	3.84	5.53	5.81	6.14	5.71	5.89	5.64
Electric power ¹⁰	3.35	4.83	5.10	5.74	5.23	5.52	5.23
Average electricity price (2015 cents per kilowatthour).....	10.3	10.5	10.6	10.9	10.8	10.5	10.4

¹Includes propane, kerosene, and distillate fuel oil.²Includes wood used for residential heating. Excludes nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.³Includes propane, motor gasoline (including ethanol and ethers), kerosene, distillate fuel oil, and residual fuel oil.⁴Includes commercial sector consumption of wood and wood waste, landfill gas, municipal waste, and other biomass for combined heat and power. Excludes nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.⁵Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.⁶Includes motor gasoline (including ethanol and ethers), residual fuel oil, petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.⁷Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources. Excludes ethanol.⁸Includes propane, motor gasoline, ethanol and ethers, jet fuel, distillate fuel oil, residual fuel oil, aviation gasoline, and lubricants.⁹Represents consumption unattributed to the sectors above.¹⁰Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.¹¹These values represent the energy obtained from uranium when it is used in light water reactors. The total energy content of uranium is much larger, but alternative processes are required to take advantage of it.¹²Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources.¹³Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes ethanol, net electricity imports, and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.¹⁴Includes non-biogenic municipal waste, liquid hydrogen, and net electricity imports.¹⁵This includes carbon dioxide from international bunker fuels, both civilian and military, which are excluded from the accounting of carbon dioxide emissions under the United Nations convention. From 1990 through 2012, international bunker fuels accounted for 90 to 126 million metric tons annually.¹⁶Includes emissions from geothermal power and emissions from non-biogenic municipal waste.¹⁷Cumulative after December 31, 2015.

Btu = British thermal unit.

-- = Not applicable.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Source: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System, runs ref2016.d032416a, and extended.d051216a.

Table D4. Natural gas supply and disposition, oil and gas resource and technology cases
(trillion cubic feet per year, unless otherwise noted)

Supply, disposition, and prices	2015	2020			2030			2040		
		Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology	Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology	Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology
Henry Hub spot price										
(2015 dollars per million Btu)	2.62	6.27	4.43	2.89	7.61	5.06	3.50	9.17	4.86	2.43
(nominal dollars per million Btu).....	2.62	6.97	4.90	3.18	10.60	6.84	4.64	16.15	8.17	3.95
Dry gas production¹	27.19	27.35	30.50	34.19	25.50	37.76	47.14	26.68	42.12	55.53
Lower 48 onshore	25.20	25.82	28.82	32.41	24.29	36.15	45.44	24.30	40.18	53.35
Tight gas	5.00	4.81	4.92	5.11	4.37	6.08	7.02	4.50	6.55	8.00
Shale gas and tight oil plays ²	13.64	14.91	17.96	21.57	14.84	25.16	33.66	15.03	29.00	41.02
Coalbed methane	1.24	1.18	1.04	0.96	1.10	0.94	0.82	0.97	0.78	0.63
Other.....	5.32	4.92	4.90	4.78	3.98	3.97	3.95	3.80	3.85	3.70
Lower 48 offshore	1.70	1.23	1.39	1.48	0.93	1.33	1.39	1.15	1.67	1.84
Alaska	0.29	0.29	0.29	0.29	0.28	0.28	0.31	1.23	0.28	0.34
Supplemental natural gas ³	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Net imports	0.95	-2.37	-2.89	-3.22	-1.59	-6.02	-10.21	-1.90	-7.55	-13.00
Pipeline ⁴	0.89	-0.14	-0.48	-0.80	0.25	-0.97	-2.02	1.62	-0.89	-2.81
Liquefied natural gas.....	0.06	-2.22	-2.42	-2.42	-1.84	-5.06	-8.19	-3.52	-6.66	-10.19
Total supply	28.20	25.04	27.67	31.03	23.98	31.80	36.99	24.84	34.63	42.59
Consumption by sector										
Residential.....	4.62	4.62	4.71	4.80	4.44	4.65	4.79	4.30	4.58	4.76
Commercial.....	3.22	3.20	3.34	3.47	3.14	3.42	3.65	3.23	3.69	4.02
Industrial ⁵	7.51	8.14	8.29	8.33	8.62	8.85	9.12	9.26	9.58	9.89
Electric power ⁶	9.61	6.29	8.26	11.10	5.12	11.02	14.60	4.76	11.96	17.94
Transportation ⁷	0.06	0.09	0.09	0.09	0.16	0.22	0.23	0.47	0.66	0.52
Pipeline fuel	0.86	0.75	0.81	0.90	0.68	0.91	1.10	0.74	1.04	1.28
Lease and plant fuel ⁸	1.58	1.57	1.71	1.88	1.46	2.00	2.47	1.51	2.24	2.94
Liquefaction for export ⁹	0.00	0.23	0.25	0.25	0.19	0.51	0.83	0.36	0.67	1.03
Total	27.47	24.89	27.46	30.83	23.81	31.59	36.78	24.64	34.42	42.38
Discrepancy ¹⁰	0.73	0.16	0.21	0.21	0.17	0.21	0.21	0.20	0.21	0.21

¹Marketed production (wet) minus extraction losses.

²Tight oil represents resources in low-permeability reservoirs, including shale and chalk formations. The specific plays included in the tight oil category are Bakken/Three Forks/Sanish, Eagle Ford, Woodford, Austin Chalk, Spraberry, Niobrara, Avalon/Bone Springs, and Monterey.

³Synthetic natural gas, propane air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.

⁴Natural gas imported from Canada and Mexico.

⁵Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems. Excludes use for lease and plant fuel.

⁶Includes consumption of energy by electricity-only and combined heat and power plants that have a regulatory status.

⁷Natural gas used as fuel in motor vehicles, trains, and ships.

⁸Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.

⁹Fuel used in facilities that liquefy natural gas for export.

¹⁰Balancing item. Natural gas lost as a result of converting flow data measured at varying temperatures and pressures to a standard temperature and pressure and the merger of different data reporting systems which vary in scope, format, definition, and respondent type. In addition, 2015 values include net storage injections.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowresource.d032516a, ref2016.d032416a, and highresource.d032516a.

Table D5. Liquid fuels supply and disposition, oil and gas resource and technology cases
(million barrels per day, unless otherwise noted)

Supply, disposition, and prices	2015	2020			2030			2040		
		Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology	Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology	Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology
Crude oil prices (2015 dollars per barrel)										
Brent spot	52	79	77	71	112	104	85	152	136	110
West Texas Intermediate spot	49	74	71	65	106	97	77	147	129	99
Imported crude oil ¹	46	71	69	63	101	95	76	139	126	95
Crude oil supply										
Domestic production ²	9.42	8.08	9.38	11.25	7.55	10.06	13.89	7.02	11.26	17.68
Alaska	0.48	0.41	0.41	0.41	0.24	0.24	0.44	0.15	0.15	0.67
Lower 48 States	8.94	7.66	8.96	10.83	7.31	9.82	13.46	6.87	11.11	17.01
Net imports	6.88	7.19	6.97	6.48	6.92	6.57	4.15	6.81	6.10	-0.02
Gross imports	7.28	7.82	7.60	7.11	7.56	7.20	6.02	7.68	7.12	6.17
Exports	0.40	0.63	0.63	0.63	0.63	0.63	1.87	0.86	1.02	6.18
Other crude oil supply ³	-0.11	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Total crude oil supply	16.19	15.28	16.36	17.74	14.47	16.63	18.04	13.83	17.36	17.67
Net product imports	-2.24	-1.61	-3.26	-5.25	-0.71	-4.32	-6.26	0.54	-4.66	-5.59
Gross refined product imports ⁴	0.66	1.18	1.11	1.07	1.46	1.30	1.11	1.96	1.63	1.27
Unfinished oil imports	0.55	0.53	0.53	0.54	0.46	0.46	0.46	0.39	0.39	0.39
Blending component imports	0.67	0.58	0.58	0.61	0.44	0.45	0.44	0.29	0.30	0.28
Exports	4.12	3.91	5.48	7.46	3.07	6.52	8.27	2.11	6.98	7.52
Refinery processing gain ⁵	1.03	1.05	1.05	1.11	0.94	0.98	0.99	0.93	0.99	0.91
Natural gas plant liquids	3.25	4.01	4.57	5.09	3.45	4.90	5.72	3.21	4.99	6.24
Supply from renewable sources	1.01	1.08	1.08	1.08	1.03	1.03	1.02	1.12	1.12	1.10
Ethanol	0.89	0.89	0.89	0.89	0.84	0.84	0.84	0.92	0.93	0.91
Domestic production	0.94	0.89	0.90	0.90	0.87	0.87	0.87	0.89	0.91	0.92
Net imports	-0.05	0.00	-0.01	-0.01	-0.03	-0.03	-0.04	0.04	0.02	-0.01
Biodiesel	0.11	0.15	0.15	0.15	0.12	0.10	0.05	0.12	0.10	0.05
Domestic production	0.08	0.12	0.11	0.11	0.08	0.06	0.01	0.08	0.06	0.01
Net imports	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Other biomass-derived liquids ⁶	0.00	0.04	0.04	0.04	0.08	0.09	0.14	0.08	0.09	0.14
Other ⁷	0.21	0.28	0.28	0.27	0.29	0.30	0.29	0.30	0.32	0.30
Total primary supply ⁸	19.46	20.08	20.08	20.03	19.46	19.52	19.80	19.93	20.12	20.63
Net import share of product supplied	23.7	28.0	18.6	6.2	32.0	11.6	-10.7	37.3	7.4	-27.0
Net expenditures for imports of crude oil & petroleum products (billion 2015 dollars)	128	220	207	179	300	268	182	412	348	231
Refined petroleum product prices to the transportation sector (2015 dollars per gallon)										
Propane	1.64	1.97	1.94	1.88	2.20	2.14	2.04	2.54	2.43	2.32
Ethanol (E85) ⁹	2.21	3.09	3.05	2.96	3.02	2.93	2.71	3.45	3.33	3.01
Ethanol wholesale price	2.22	2.80	2.77	2.72	2.33	2.28	2.28	2.64	2.60	2.48
Motor gasoline ¹⁰	2.52	2.81	2.74	2.64	3.37	3.19	2.78	4.10	3.81	3.13
Jet fuel ¹¹	1.62	2.26	2.18	2.05	3.08	2.87	2.44	4.09	3.74	2.91
Distillate fuel oil ¹²	2.72	3.24	3.18	3.05	4.03	3.85	3.42	5.01	4.68	3.87
Residual fuel oil	1.21	1.77	1.75	1.64	2.40	2.25	1.80	3.13	2.87	2.14

¹Weighted average price delivered to U.S. refiners.

²Includes lease condensate.

³Strategic petroleum reserve stock additions plus unaccounted for crude oil and crude stock withdrawals minus crude product supplied.

⁴Includes other hydrocarbons and alcohol.

⁵The volumetric amount by which total output is greater than input due to the processing of crude oil into products which, in total, have a lower specific gravity than the crude oil processed.

⁶Includes pyrolysis oils, biomass-derived Fischer-Tropsch liquids, biobutanol, and renewable feedstocks used for the on-site production of diesel and gasoline.

⁷Includes domestic sources of other blending components, other hydrocarbons, and ethers.

⁸Total crude supply, net product imports, refinery processing gain, natural gas plant liquids, supply from renewable sources, and other supply.

⁹E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

¹⁰Sales weighted-average price for all grades. Includes Federal, State, and local taxes.

¹¹Includes only kerosene-type.

¹²Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Sources: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowresource.d032516a, ref2016.d032416a, and highresource.d032516a.

Table D6. Key transportation results, oil and gas resource and technology cases

Key indicators and consumption	2015	2020			2030			2040		
		Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology	Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology	Low Oil and Gas Resource and Technology	Reference	High Oil and Gas Resource and Technology
Level of travel										
(billion vehicle miles traveled)										
Light-duty vehicles less than 8,501 lbs	2,752	3,019	3,031	3,043	3,191	3,232	3,332	3,364	3,438	3,656
Commercial light trucks ¹	96	110	110	109	124	125	127	140	143	146
Freight trucks greater than 10,000 lbs.	280	303	304	304	343	349	356	395	407	417
(billion seat miles available)										
Air	1,070	1,166	1,168	1,170	1,360	1,364	1,373	1,529	1,531	1,536
(billion ton miles traveled)										
Rail	1,690	1,805	1,810	1,811	1,983	2,006	2,037	2,085	2,128	2,171
Domestic shipping	482	448	453	455	387	404	420	378	407	431
Energy efficiency indicators										
(miles per gallon)										
Tested new light-duty vehicle ²	30.9	37.0	36.9	36.8	47.5	47.2	46.7	48.1	47.8	47.1
New car ²	35.9	44.2	44.2	44.2	55.2	55.1	54.9	55.3	55.1	54.9
New light truck ²	27.0	31.8	31.7	31.7	40.5	40.4	40.3	40.5	40.4	40.4
On-road new light-duty vehicle ³	25.0	29.9	29.8	29.7	38.4	38.2	37.7	38.9	38.6	38.0
New car ³	29.3	36.1	36.1	36.1	45.1	45.0	44.9	45.1	45.0	44.8
New light truck ³	21.6	25.4	25.4	25.4	32.4	32.3	32.3	32.4	32.3	32.3
Light-duty stock ⁴	21.7	24.1	24.1	24.1	31.5	31.5	31.4	36.5	36.3	36.0
New commercial light truck ¹	17.3	19.6	19.5	19.5	24.0	24.0	23.9	24.1	24.0	24.0
Stock commercial light truck ¹	15.0	16.6	16.6	16.6	20.8	20.8	20.9	23.2	23.2	23.2
Freight truck	6.9	7.3	7.3	7.3	7.8	7.8	7.8	8.0	8.0	7.9
Energy use by mode (quadrillion Btu)										
Light-duty vehicles	15.86	15.66	15.73	15.80	12.63	12.82	13.26	11.52	11.83	12.71
Commercial light trucks ¹	0.80	0.82	0.82	0.82	0.74	0.75	0.76	0.76	0.77	0.79
Bus transportation	0.26	0.27	0.27	0.27	0.29	0.29	0.29	0.31	0.31	0.31
Freight trucks	5.57	5.74	5.76	5.75	6.06	6.16	6.30	6.77	6.98	7.20
Rail, passenger	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06
Rail, freight	0.48	0.50	0.50	0.50	0.51	0.51	0.52	0.50	0.51	0.52
Shipping, domestic and international	0.83	0.73	0.73	0.73	0.74	0.77	0.84	0.77	0.82	0.89
Air	2.37	2.51	2.52	2.52	2.81	2.82	2.84	2.99	3.00	3.01
Other uses ⁴	1.03	1.06	1.06	1.06	1.11	1.12	1.12	1.22	1.22	1.24
Pipeline fuel	0.89	0.77	0.83	0.93	0.71	0.94	1.13	0.76	1.07	1.32
Total	28.14	28.12	28.28	28.44	25.66	26.24	27.12	25.65	26.57	28.04
Energy use by fuel (quadrillion Btu)										
Propane	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
Motor gasoline ⁵	17.01	16.72	16.79	16.85	13.41	13.62	14.07	12.20	12.55	13.44
of which: E85 ⁶	0.05	0.04	0.04	0.03	0.24	0.22	0.16	0.32	0.28	0.20
Jet fuel ⁷	2.84	2.99	2.99	3.00	3.31	3.32	3.34	3.55	3.56	3.57
Distillate fuel oil ⁸	6.67	6.97	6.99	6.99	7.44	7.49	7.65	7.97	8.01	8.41
Residual fuel oil	0.45	0.37	0.37	0.37	0.39	0.42	0.47	0.42	0.45	0.52
Other petroleum ⁹	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Liquid fuels and other petroleum	27.14	27.22	27.32	27.38	24.73	25.01	25.70	24.32	24.75	26.13
Pipeline fuel natural gas	0.89	0.77	0.83	0.93	0.71	0.94	1.13	0.76	1.07	1.32
Compressed/liquefied natural gas	0.07	0.08	0.08	0.09	0.10	0.17	0.18	0.40	0.59	0.44
Liquid hydrogen	0.00	0.01	0.01	0.01	0.04	0.04	0.04	0.06	0.06	0.06
Electricity	0.03	0.05	0.05	0.05	0.11	0.11	0.11	0.15	0.15	0.16
Delivered energy use	28.13	28.13	28.29	28.45	25.69	26.28	27.17	25.70	26.63	28.12

¹Commercial trucks 8,501 to 10,000 pounds gross vehicle weight rating.

²Tested new vehicle efficiency revised for on-road performance.

³Combined "on-the-road" estimate for all cars and light trucks.

⁴Includes recreational boats, military use, and lubricants.

⁵Includes ethanol and ethers blended into gasoline.

⁶E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.

⁷Includes only kerosene type.

⁸Diesel fuel for on- and off- road use.

⁹Includes aviation gasoline and lubricants.

Lbs = Pounds.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Source: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System runs lowresource.d032516a, ref2016.d032416a, and highresource.d032516a.

Table D7. Key results for industrial energy efficiency cases
(quadrillion Btu per year, unless otherwise noted)

Consumption and emissions	2015	2025				2040			
		Reference	Energy Efficiency	Low Incentive	High Incentive	Reference	Energy Efficiency	Low Incentive	High Incentive
Energy consumption									
Industrial¹									
Cement and lime									
Petroleum and other liquids.....	0.04	0.09	0.10	0.09	0.09	0.14	0.13	0.14	0.14
Natural gas.....	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Coal.....	0.14	0.17	0.15	0.17	0.17	0.19	0.16	0.19	0.19
Renewable energy ²	0.09	0.13	0.12	0.13	0.13	0.16	0.14	0.16	0.16
Electricity.....	0.05	0.06	0.05	0.06	0.06	0.07	0.06	0.07	0.07
Total cement and lime.....	0.33	0.47	0.43	0.47	0.45	0.58	0.51	0.57	0.57
Aluminum									
Petroleum and other liquids.....	0.03	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.03
Natural gas.....	0.11	0.13	0.11	0.14	0.15	0.13	0.11	0.14	0.14
Electricity.....	0.20	0.23	0.20	0.23	0.22	0.21	0.19	0.21	0.20
Total aluminum.....	0.34	0.42	0.38	0.42	0.42	0.40	0.36	0.40	0.37
Glass									
Petroleum and other liquids.....	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Natural gas.....	0.17	0.19	0.19	0.19	0.18	0.19	0.16	0.17	0.16
Electricity.....	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Total glass.....	0.24	0.27	0.26	0.27	0.26	0.27	0.24	0.25	0.23
Iron and steel									
Petroleum and other liquids.....	0.07	0.10	0.09	0.09	0.08	0.13	0.13	0.13	0.14
Natural gas.....	0.40	0.43	0.37	0.42	0.39	0.45	0.40	0.48	0.49
Coal.....	0.56	0.50	0.47	0.45	0.33	0.47	0.44	0.43	0.41
Electricity.....	0.18	0.23	0.23	0.23	0.20	0.29	0.29	0.30	0.30
Total iron and steel.....	1.21	1.26	1.17	1.20	1.00	1.34	1.25	1.34	1.34
Paper									
Petroleum and other liquids.....	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.04
Natural gas.....	0.39	0.37	0.30	0.37	0.36	0.37	0.30	0.38	0.37
Coal.....	0.20	0.21	0.18	0.21	0.20	0.24	0.21	0.25	0.24
Renewable energy ²	0.99	0.99	0.99	0.98	0.96	1.07	1.08	1.08	1.07
Electricity.....	0.20	0.18	0.14	0.17	0.16	0.15	0.13	0.14	0.13
Total paper.....	1.81	1.79	1.64	1.77	1.71	1.87	1.75	1.88	1.84
Other industries									
Petroleum and other liquids.....	7.86	9.87	9.86	9.73	9.38	11.42	11.41	11.10	10.77
Natural gas.....	8.30	10.20	10.22	10.14	9.85	11.73	11.75	11.57	11.40
Coal.....	0.44	0.43	0.43	0.43	0.42	0.45	0.45	0.44	0.44
Renewable energy ²	1.18	1.27	1.27	1.26	1.25	1.39	1.39	1.37	1.37
Electricity.....	2.62	3.17	3.17	3.11	2.97	3.51	3.50	3.40	3.28
Total other industries.....	20.40	24.94	24.95	24.67	23.87	28.49	28.50	27.89	27.27
Total industrial sector									
Petroleum and other liquids.....	8.07	10.19	10.19	10.05	9.68	11.82	11.80	11.51	11.16
Natural gas.....	9.38	11.34	11.21	11.28	10.94	12.89	12.74	12.75	12.58
Coal.....	1.34	1.31	1.23	1.26	1.12	1.34	1.26	1.31	1.28
Renewable energy ²	2.26	2.39	2.38	2.38	2.33	2.63	2.61	2.62	2.60
Electricity.....	3.27	3.91	3.83	3.83	3.65	4.26	4.21	4.15	4.01
Total industrial sector.....	24.33	29.14	28.83	28.80	27.71	32.94	32.62	32.34	31.63
Total delivered energy consumption									
Petroleum and other liquids.....	36.23	37.18	37.19	36.84	35.99	37.44	37.42	36.67	35.70
Natural gas.....	18.43	20.61	20.48	20.47	19.91	23.09	22.95	22.77	22.26
Coal.....	1.40	1.36	1.28	1.31	1.17	1.39	1.31	1.36	1.34
Renewable energy ³	2.84	2.94	2.92	2.93	2.90	3.13	3.11	3.13	3.13
Electricity.....	12.72	13.60	13.53	13.37	12.95	15.23	15.19	14.82	14.38
Total.....	71.62	75.73	75.44	74.94	72.95	80.34	80.04	78.81	76.87
Electricity related losses.....	25.12	25.83	25.70	24.94	22.61	26.81	26.80	25.08	24.92
Total energy consumption.....	96.74	101.56	101.14	99.89	95.56	107.15	106.84	103.88	101.79

Table D7. Key results for industrial energy efficiency cases (continued)
(quadrillion Btu per year, unless otherwise noted)

Consumption and emissions	2015	2025				2040			
		Reference	Energy Efficiency	Low Incentive	High Incentive	Reference	Energy Efficiency	Low Incentive	High Incentive
Carbon dioxide emissions⁴									
(million metric tons)									
Residential.....	1,028	895	895	817	617	821	825	642	477
Commercial	918	836	837	756	550	826	830	632	450
Industrial ¹	1,472	1,600	1,575	1,523	1,316	1,660	1,637	1,498	1,341
Cement and lime	24	32	30	31	28	38	33	35	34
Aluminum	40	42	38	40	30	35	32	29	19
Glass	16	17	17	17	15	17	15	15	12
Iron and steel.....	108	106	101	98	72	107	101	97	88
Paper.....	72	65	53	62	52	60	52	56	51
Other industries	1,212	1,337	1,337	1,276	1,120	1,403	1,404	1,266	1,138
Transportation	1,855	1,784	1,785	1,770	1,735	1,737	1,737	1,703	1,657
Total carbon dioxide emissions	5,273	5,115	5,092	4,865	4,217	5,044	5,029	4,475	3,925

¹Includes energy for combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

²Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources. Excludes ethanol in motor gasoline.

³Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes ethanol and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal water heaters.

⁴Emissions from the electric power sector are distributed to the end-use sectors.

Btu = British thermal unit.

Note: Totals may not equal sum of components due to independent rounding. Data for 2015 are model results and may differ from official EIA data reports.

Source: 2015: U.S. Energy Information Administration, (EIA), *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a. Projections: EIA, AEO2016 National Energy Modeling System, runs ref2016.d032416a, efficienttech.d032516a, lowinnovate.d032516a, and highinnovate.D032516a.

The National Energy Modeling System

Projections in the *Annual Energy Outlook 2016* (AEO2016) are generated using the National Energy Modeling System (NEMS) [1], developed and maintained by the Office of Energy Analysis of the U.S. Energy Information Administration (EIA). In addition to its use in developing the *Annual Energy Outlook* (AEO) projections, NEMS is used to complete analytical studies for the U.S. Congress, the Executive Office of the President, other offices within the U.S. Department of Energy, and other federal agencies. NEMS is also used by nongovernment groups, such as the Electric Power Research Institute, Duke University, and Georgia Institute of Technology. In addition, AEO projections are used by analysts and planners in other government agencies and nongovernmental organizations.

The projections in NEMS are developed with the use of a market-based approach, subject to regulations and standards. For each fuel and consuming sector, NEMS balances energy supply and demand, accounting for economic competition across the various energy fuels and sources. The time horizon of NEMS extends to 2040. To represent regional differences in energy markets, the component modules of NEMS function at the regional level: the 9 Census divisions for the end-use demand modules; production regions specific to oil, natural gas, and coal supply and distribution; 22 regions and subregions of the North American Electric Reliability Corporation for electricity; and 9 refining regions that are a subset of the 5 Petroleum Administration for Defense Districts.

NEMS is organized and implemented as a modular system. The modules represent each of the fuel supply markets, conversion sectors, and end-use consumption sectors of the energy system. The modular design also permits the use of the methodology and level of detail most appropriate for each energy sector. NEMS executes each of the component modules to solve for prices of energy delivered to end users and the quantities consumed, by product, region, and sector. The delivered fuel prices encompass all activities necessary to produce, import, and transport fuels to end users. The information flows also include such areas as economic activity, domestic production, and international petroleum supply. NEMS calls each supply, conversion, and end-use demand module in sequence until the delivered prices of energy and the quantities demanded have converged within tolerance, thereby achieving an economic equilibrium of supply and demand in the consuming sectors. A solution is reached for each year from 2015 through 2040. Other variables, such as petroleum product imports, crude oil imports, and several macroeconomic indicators, also are evaluated for convergence.

Each NEMS component represents the effects and costs of legislation and environmental regulations that affect each sector. NEMS accounts for all energy-related carbon dioxide emissions, as well as emissions of sulfur dioxide, nitrogen oxides, and mercury from the electricity generation sector.

The version of NEMS used for AEO2016 generally represents current legislation and environmental regulations, including recent government actions for which implementing regulations were available as of February 29, 2016, as discussed in the AEO2016 Legislation and Regulations section. The potential effects of proposed federal and state legislation, regulations, or standards—or of sections of legislation that have been enacted but require funds or implementing regulations that have not been provided or specified—are not reflected in NEMS. Many of the pending provisions are examined, however, in alternative cases included in AEO2016 or in other analysis completed by EIA.

In general, the historical data presented with AEO2016 projections are based on various EIA publications [2]; however, data also were taken from multiple non-EIA sources. Historical numbers through the year 2015 are presented for comparison only and may be estimates. Source documents should be consulted for the official data values. Footnotes to AEO2016 appendix tables indicate the definitions and sources of historical data.

Where possible, AEO2016, which was developed during the winter of 2015–16, presents information for 2015, 2016, and 2017 that is consistent with the short-term projections from EIA's February 2016 Short-Term Energy Outlook (STEO) [3]. EIA's views regarding energy use over the 2016 through 2017 period are reported in monthly STEO updates, which should be considered to supersede information reported for those years in AEO2016.

Component modules

The component modules of NEMS represent the individual supply, demand, and conversion sectors of domestic energy markets and also include international and macroeconomic modules. In general, the modules interact through values representing prices or expenditures for energy delivered to the consuming sectors, and the quantities of end-use energy consumption.

Macroeconomic Activity Module

The Macroeconomic Activity Module (MAM) provides a set of macroeconomic drivers to the energy modules and receives energy-related indicators from the NEMS energy components as part of the macroeconomic feedback mechanism within NEMS. Key macroeconomic variables used in the energy modules include gross domestic product, disposable income, values of industrial shipments, new housing starts, sales of new light-duty vehicles (LDVs), interest rates, and employment. Key energy indicators fed back to the MAM include aggregate energy prices and quantities. The MAM uses the following models from IHS Global Insight: Macroeconomic Model of the U.S. Economy, National Industrial Output Model, and National Employment by Industry Model.

In addition, EIA has constructed a Regional Economic, Industrial Output and Employment by Industry model to project regional economic drivers, and a Commercial Floorspace model to project growth rates in 13 floorspace types in the nine Census divisions. The accounting framework for industrial value of shipments uses the North American Industry Classification System (NAICS).

International Energy Module

The International Energy Module (IEM) uses assumptions about economic growth and expectations of future U.S. and world petroleum and other liquids production and consumption, by year, to project the interaction of U.S. and international petroleum and other liquids markets. The IEM module provides a supply curve for world crude-like liquids and generates a worldwide oil supply/demand balance for each year of the projection period. The supply-curve calculations are based on historical market data and a world oil supply/demand balance, which is developed from reduced-form models of international petroleum and other liquids supply and demand, current investment trends in exploration and development, and long-term resource economics by country and territory. The oil production estimates include both petroleum and other liquids supply recovery technologies. The IEM also provides, for each year of the projection period, endogenous assumptions about petroleum products for import and export in the United States. The IEM, through interaction with the rest of NEMS, changes North Sea Brent and West Texas Intermediate prices in response to changes in expected production and consumption of crude-like liquids and petroleum products in the United States.

Residential and Commercial Demand Modules

The Residential Demand Module projects energy consumption in the residential sector by Census division, housing type, and end use, based on delivered energy prices, the menu of equipment available, the availability of renewable sources of energy, and changes in the housing stock. The Commercial Demand Module projects energy consumption in the commercial sector by Census division, building type, and category of end use, based on delivered prices of energy, the menu of available equipment, availability of renewable sources of energy, and changes in commercial floorspace.

Both modules estimate the equipment stock for the major end-use services, incorporating assessments of advanced technologies, representations of renewable energy technologies, and the effects of both building shell and appliance standards. The modules also include projections of distributed generation. The Commercial Demand Module also incorporates combined heat and power technology. Both modules incorporate projections of heating and cooling degree-days by Census division, based on a 30-year historical trend and on state-level population projections. The Residential Demand Module projects an increase in the average square footage of both new construction and existing structures, based on trends in new construction and remodeling.

The investment tax credit (ITC) for renewable fuels, fuel cells, and combined heat and power systems is incorporated, as currently enacted, including a phaseout of the credit for solar energy technologies, followed by a permanent 10% ITC for business investment in solar energy (thermal nonpower uses as well as power uses). The module reflects the recently extended deadline and change in eligibility for the 30% ITC for eligible projects under construction before January 1, 2020. The module additionally captures the ITC phaseout—decreasing the credit for solar projects starting construction in 2020 and 2021 to 26% and 22%, respectively. Commercial projects under construction after 2021 receive a credit equivalent to 10% of capital costs. Tax credits for solar systems purchased by individual homeowners are phased out completely by 2022.

Industrial Demand Module

The Industrial Demand Module (IDM) projects the consumption of energy for heat and power, as well as the consumption of feedstocks and raw materials in each of 21 industry groups, subject to the delivered prices of energy and macroeconomic estimates of employment and the value of shipments for each industry. As noted in the description of the Macroeconomic Activity Module, the representation of industrial activity in NEMS is based on the NAICS. The industries are classified into three groups—energy-intensive manufacturing, nonenergy-intensive manufacturing, and nonmanufacturing. Seven of eight energy-intensive manufacturing industries are modeled in the IDM, including energy-consuming components for boiler/steam/cogeneration, buildings, and process/assembly use of energy. Energy demand for petroleum and other liquids refining (the other energy-intensive manufacturing industry) is modeled in the Liquid Fuels Market Module as described below, but the projected consumption is reported under the industrial totals.

There are several AEO2016 updates and upgrades in the representations of selected industries, including upgraded representations for the iron and steel and paper industries. Instead of assuming that technological development for a particular process occurs on a predetermined or exogenous path based on engineering judgment, these upgrades allow technological change in the iron and steel and paper industries to be modeled endogenously, using a more detailed representation of technology choices. The upgrade allows for explicit technological change, and therefore energy intensity, to respond to economic, regulatory, and other conditions. To model technology choices more accurately, the paper industry shipments have been broken out into pulp and paper mills, paperboard containers, and other paper. For iron and steel and for paper, steam use is modeled in the process/assembly step. All manufacturing industries except cement and lime, aluminum, and glass are benchmarked to the Manufacturing Energy Consumption Survey 2010. The combined cement and lime industries, aluminum industry, and glass industry were upgraded to technology choice models in previous editions of the *Annual Energy Outlook*.

Transportation Demand Module

The Transportation Demand Module projects consumption of energy by mode and fuel—including petroleum products, electricity, methanol, ethanol, compressed natural gas, liquefied natural gas, and hydrogen—in the transportation sector, subject to delivered energy prices, macroeconomic variables such as gross domestic product, and other factors such as technology adoption and consumer behavior. The Transportation Demand Module includes legislation and regulations—such as the Energy Policy Act of 2005 (EPACT2005), the Energy Improvement and Extension Act of 2008, and the American Recovery and Reinvestment Act of 2009—which contain tax credits for the purchase of alternatively fueled vehicles. Representations of corporate average fuel economy and greenhouse gas (GHG) emissions standards for LDVs, heavy-duty vehicle (HDV) fuel consumption and GHG emissions standards, and biofuels consumption reflect standards enacted by the National Highway Traffic Safety Administration (NHTSA) and the U.S. Environmental Protection Agency (EPA), as well as provisions in the Energy Independence and Security Act of 2007 and the California Air Resources Board Zero Emissions Vehicle Program.

The air transportation component of the Transportation Demand Module represents air travel in domestic and foreign markets and includes the industry practice of parking aircraft in both domestic and international markets to reduce operating costs, as well as the movement of aging aircraft from passenger to cargo markets. For passenger travel and air freight shipments, the module represents regional fuel use and travel demand for three aircraft types: regional, narrow-body, and wide-body. An infrastructure constraint, which is also modeled, can potentially limit overall growth in passenger and freight air travel to levels commensurate with industry-projected infrastructure expansion and capacity growth.

The Transportation Demand Module also projects energy consumption for freight and passenger rail and marine vessels by mode and fuel, subject to macroeconomic variables such as the value and type of industrial shipments. Freight ton-miles and efficiency also are projected in the model. Legislation such as the International Convention for the Prevention of Pollution from Ships is also included.

Electricity Market Module

There are three primary submodules of the Electricity Market Module (EMM)—capacity planning, fuel dispatching, and finance and pricing. The capacity expansion submodule uses the stock of existing generation capacity, known environmental regulations, the expected cost and performance of future generation capacity, expected fuel prices, expected financial parameters, and expected electricity demand to project the optimal mix of new generation capacity that should be added in future years. The fuel dispatching submodule uses the existing stock of generation equipment types, their operation and maintenance costs and performance, fuel prices to the electricity sector, electricity demand, and all applicable environmental regulations to determine the least-cost way to meet that demand. This submodule also determines interregional trading and costs of electricity generation. The finance and pricing submodule uses capital costs, fuel and operating costs, macroeconomic parameters, environmental regulations, and load shapes to estimate retail prices by sector for generation, transmission, and distribution services.

All specifically identified options promulgated by EPA for compliance with the Clean Air Act Amendments of 1990 are explicitly represented in the capacity expansion and dispatch decisions. All financial incentives for power generation expansion and dispatch specifically identified in EPACT2005 have been implemented. Several states, primarily in the Northeast, have enacted air emission regulations for carbon dioxide (CO₂) that affect the electricity generation sector, and those regulations are represented in AEO2016. The AEO2016 Reference case also imposes a limit on CO₂ emissions for specific covered sectors, including the electric power sector in California as represented in California Assembly Bill 32, the Global Warming Solutions Act of 2006 (AB 32). The AEO2016 Reference case includes the Cross-State Air Pollution Rule (CSAPR), using the original emissions budgets and revised implementation schedule, after the rule was reinstated in late 2014. CSAPR is intended to reduce emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x) from power plants in the eastern half of the United States by imposing state-level caps on emissions and facilitating a limited interstate cap-and-trade program. Reductions in hazardous air pollutant emissions from coal- and oil-fired steam electric power plants also are reflected through the inclusion of the Mercury and Air Toxics Standards for power plants, finalized by EPA in December 2011.

In August 2015, EPA released final rules under the Clean Air Act Sections 111(b) and 111(d) setting carbon pollution standards for new, modified, and reconstructed power plants and for existing fossil-fired plants. The requirements for new power plants are represented in the Reference case by allowing new technologies to be built only if they can meet the standards of 1,000 pounds CO₂ per megawatt-hour (MWh) for natural gas combined cycle plants, and 1,400 pounds CO₂/MWh for coal-fired plants, based on adjusted gross generation. EPA's Clean Power Plan (CPP) establishes emissions standards for existing power plants and provides many alternative ways for states to demonstrate compliance, as discussed in the AEO2016 Legislation and Regulations section. The Reference case assumes that the CPP is met through regional mass-based goals, implemented at the 22 EMM region level. The Supreme Court has stayed enforcement of the CPP pending resolution of ongoing litigation, but as of this writing no lower court has either affirmed or vacated the rule. The AEO2016 also includes a case that assumes no CPP rule is in force.

Because regulators and the investment community have continued to push energy companies to invest in technologies that are less GHG-intensive, there is considerable financial risk associated with major investments in long-lived power plants with relatively higher rates of carbon dioxide emissions. The trend is captured in the AEO2016 Reference case through a 3-percentage-point increase in the cost of capital when evaluating investments in new coal-fired power plants, new coal-to-liquids (CTL) plants

without carbon capture and storage (CCS), and pollution control retrofits. Although any new coal-fired plants are assumed to be compliant with CAA 111(b), they would capture only 30% of CO₂ emissions; thus, they still would be considered high emitters relative to other sources and would face potential financial risk.

Renewable Fuels Module

The Renewable Fuels Module (RFM) includes submodules representing renewable resource supply and technology input information for central-station, grid-connected electricity generation technologies, including conventional hydroelectricity, biomass (dedicated biomass plants and co-firing in existing coal plants), geothermal, landfill gas, solar thermal electricity, solar photovoltaics, and both onshore and offshore wind energy. The RFM includes renewable resource supply estimates representing the regional opportunities for renewable energy development.

The ITC for renewable fuels, as currently enacted, is incorporated in the RFM and reflect the recently extended deadline and change in eligibility for the 30% ITC for qualified projects under construction before January 1, 2020. The module additionally captures the ITC phaseout—decreasing to 26% and then 22%—for projects starting construction in 2020 and 2021, respectively. After 2021, all solar (thermal nonpower uses as well as power uses) receive a permanent credit equivalent to 10% of capital costs, regardless of the year in which their construction commenced. Tax credits pertaining to individual homeowners and businesses are reflected separately in the Residential and Commercial Demand Modules.

The recently enacted production tax credit (PTC) for wind, geothermal, biomass-fueled (open-loop biomass is assumed to be the dominant source), landfill gas, and certain types of hydroelectric plants also are represented in the RFM. For wind projects, the tax credit retains its full value of 2.3 cents/kilowatt-hour (kWh) through 2016. The PTC phaseout begins in January 2017 with a step-down schedule as follows:

- Wind projects under construction after 2016, but before the end of 2017, receive a credit equal to 80% of the current PTC value.
- Wind projects under construction in 2018 receive a credit equal to 60% of the current value.
- Wind projects under construction after 2018, but before the end of 2019, receive a credit equal to 40% of the current value.

Eligibility is extended for 2 years, until January 1, 2017, with no phase-down in value for other PTC-eligible technologies. Geothermal facilities receive the full 2.3 cents/kWh, while other technologies (including open-loop biomass, certain waste energy facilities, incremental hydroelectric, marine, and tidal) receive a half-value credit of 1.2 cents/kWh. The credits are adjusted annually for inflation and are claimed during the first 10 years of a plant's operation. In addition, new geothermal facilities continue to receive a 10% ITC after the PTC expires because they were previously eligible for the 10% ITC.

While current legislation allows PTC-eligible technologies the option to claim the ITC in lieu of the PTC (subject to the same PTC phaseout schedule), EIA assigns the most economically beneficial tax credit option, based on analyst judgment. AEO2016 also accounts for new renewable energy capacity resulting from state renewable portfolio standard programs, mandates, and goals, as described in *Assumptions to the Annual Energy Outlook 2016* [4].

Oil and Gas Supply Module

The Oil and Gas Supply Module represents domestic crude oil and natural gas supply within an integrated framework that captures the interrelationships among the various sources of supply—onshore, offshore, and Alaska—by all production techniques, including natural gas recovery from coalbeds and low-permeability geologic formations. The framework analyzes cash flow and profitability to compute investment and drilling for each of the supply sources, based on the prices for crude oil and natural gas, the domestic recoverable resource base, and the state of technology. Oil and natural gas production activities are modeled for 12 supply regions, including six onshore, three offshore, and in three Alaska regions.

The Onshore Lower 48 Oil and Gas Supply Submodule evaluates the economics of future exploration and development projects for crude oil and natural gas plays. Crude oil resources include structurally reservoirized resources (i.e., conventional) as well as highly fractured continuous zones, such as the Austin Chalk and Bakken shale formations. Production potential from advanced secondary recovery techniques (such as infill drilling, horizontal continuity, and horizontal profile) and enhanced oil recovery (such as CO₂ flooding, steam flooding, polymer flooding, and profile modification) are explicitly represented. Natural gas resources include high-permeability carbonate and sandstone, tight gas, shale gas, and coalbed methane.

Domestic crude oil production volumes are used as inputs to the Liquid Fuels Market Module (LFMM) for conversion and blending into refined petroleum products. Supply curves for natural gas are used as inputs to the Natural Gas Transmission and Distribution Module (NGTDM) for determining natural gas wellhead prices and domestic production.

Natural Gas Transmission and Distribution Module

The Natural Gas Transmission and Distribution Module (NGTDM) models the transmission, distribution, and pricing of natural gas, subject to end-use demand for natural gas, the availability of domestic natural gas, and natural gas traded on the international market. The module balances natural gas supply and demand, tracks the flows of natural gas, and determines the associated capacity expansion requirements in an aggregate pipeline network, connecting domestic and limited foreign supply sources with 12 regions in the Lower 48 states. The 12 regions align with the 9 Census divisions (with 3 subdivided). Alaska is handled separately.

The flow of natural gas is determined for both a peak and an off-peak period in the year, assuming a historically based seasonal distribution of natural gas demand. Key components of pipeline and distributor tariffs are included in separate pricing algorithms. The primary outputs of the module are delivered natural gas prices by region and sector, supply prices, and realized domestic natural gas production. The module also projects natural gas pipeline imports and exports to Canada and Mexico, as well as liquefied natural gas imports and exports.

Liquid Fuels Market Module

The Liquid Fuels Market Module (LFMM) projects prices of petroleum products, crude oil and product import/export activity, and domestic refinery operations, subject to demand for petroleum products, availability and price of imported petroleum, environmental regulations, and domestic production of crude oil, natural gas liquids, and biofuels—ethanol, biodiesel, biomass-to-liquids (BTL), CTL, gas-to-liquids (GTL), and coal-and-biomass-to-liquids (CBTL). Costs, performance, and first dates of commercial availability for the advanced liquid fuels technologies [5] are reviewed and updated annually.

The module represents refining activities in eight U.S. regions and a Maritime Canada/Caribbean refining region (created to represent short-haul international refineries that predominantly serve U.S. markets). For better representation of policy, import/export patterns, and biofuels production, the eight U.S. regions are defined by subdividing three of the five U.S. Petroleum Administration for Defense Districts. The nine refining regions are defined below:

- Region 1. PADD I - East Coast
- Region 2. PADD II - Midwest - inland
- Region 3. PADD II - Midwest - lakes
- Region 4. PADD III - Gulf Coast - gulf
- Region 5. PADD III - Gulf Coast - inland
- Region 6. PADD IV - Rocky Mountain
- Region 7. PADD V - West Coast - California
- Region 8. PADD V - West Coast - other
- Region 9. Maritime Canada/Caribbean.

The LFMM models the costs of producing automotive fuels, such as conventional and reformulated gasoline, and includes production of biofuels for blending in gasoline and diesel. Fuel ethanol and biodiesel are included in the LFMM because they are commonly blended into petroleum products. The module allows ethanol blending into gasoline at 10% by volume, 15% by volume in states that lack explicit language capping ethanol volume or oxygen content, and up to 85% by volume for use in flex-fuel vehicles. The module also includes a 16% (by volume) biobutanol/gasoline blend. Crude oil and refinery product imports are represented by supply curves defined by the NEMS IEM. Products also can be imported from refining Region 9 (Maritime Canada/Caribbean). Refinery product exports are represented by demand curves, also provided by the IEM. Crude exports from the United States also are represented.

Capacity expansion of refinery process units and nonpetroleum liquid fuels production facilities is also modeled in the LFMM. The model uses current liquid fuels production capacity, the cost and performance of each production unit, expected fuel and feedstock costs, expected financial parameters, expected liquid fuels demand, and relevant environmental policies to project the optimal mix of new capacity that should be added in the future.

The LFMM includes representation of the Renewable Fuels Standard (RFS) specified in the Energy Independence and Security Act of 2007, which mandates the use of 36 billion gallons of ethanol equivalent renewable fuel by 2022. Both domestic and imported biofuels count toward the RFS. Domestic ethanol production is modeled for three feedstock categories: corn, cellulosic plant materials, and advanced feedstock materials. Corn ethanol plants, which are numerous (responsible for 98% of total ethanol produced in the U.S.), are based on a well-known technology that converts starch and sugar into ethanol. Ethanol from cellulosic sources is a new technology with only a few small pilot plants in operation. Ethanol from advanced feedstocks, which are produced at ethanol refineries that ferment and distill grains other than corn and reduce greenhouse gas emissions by at least 50%, is another new technology modeled in the LFMM. The LFMM also has the capability to model production of biobutanol from a retrofitted corn ethanol facility, if economically competitive.

Fuels produced by Fischer-Tropsch synthesis or through a pyrolysis process also are modeled in the LFMM, based on their economics in comparison with competing feedstocks and products. The five processes modeled are CTL, CBTL, GTL, BTL, and pyrolysis.

Two California-specific policies also are represented in the LFMM: the Low Carbon Fuel Standard (LCFS) and the Assembly Bill 32, the Global Warming Solutions Act of 2006 (AB 32), cap-and-trade program. The LCFS requires the carbon intensity of transportation fuels sold for use in California (the amount of greenhouse gases emitted per unit of energy) to decrease according to a schedule published by the California Air Resources Board. California's AB 32 cap-and-trade program is established to help California achieve its goal of reducing CO₂ emissions to 1990 levels by 2020. Working with other NEMS modules (Industrial Demand Module, EMM,

and Emissions Policy Module), the LFMM provides emissions allowances and actual emissions of CO₂ from California refineries, and NEMS provides the mechanism (carbon price) to trade allowances such that the total CO₂ emissions cap is met.

Coal Market Module

The Coal Market Module (CMM) simulates mining, transportation, and pricing of coal, subject to end-use demand for coal differentiated by heat and sulfur content. U.S. coal production is represented in the CMM by 41 separate supply curves—differentiated by region, mine type, coal rank, and sulfur content. The coal supply curves respond to mining capacity, capacity utilization of mines, labor productivity, and factor input costs (mining equipment, mining labor, and fuel requirements). Projections of U.S. coal distribution are determined by minimizing the cost of coal supplied, given coal demands by region and sector; environmental restrictions; and accounting for minemouth prices, transportation costs, and coal supply contracts. Over the projection horizon, coal transportation costs in the CMM vary in response to changes in the cost of rail investments.

The CMM produces projections of U.S. steam and metallurgical coal exports and imports in the context of world coal trade, determining the pattern of world coal trade flows that minimizes production and transportation costs while meeting a specified set of regional coal import demands, subject to constraints on export capacities and trade flows. The international coal market component of the module computes trade in two types of coal (steam and metallurgical) for 17 export regions and 20 import regions. U.S. coal production and distribution are computed for 14 supply regions and 16 demand regions.

Annual Energy Outlook 2016 cases

Table E1 provides a summary of the cases produced as part of AEO2016. For each case, the table gives the name used in AEO2016, a brief description of the major assumptions underlying the projections, and a reference to the pages in the body of the report and in this appendix where the case is discussed. The text sections following Table E1 describe the various cases in more detail. The Reference case assumptions for each sector are described in Assumptions to the *Annual Energy Outlook 2016*. Regional results and other details of the projections are available at http://www.eia.gov/forecasts/aeo/tables_ref.cfm#supplement.

Macroeconomic growth cases

In addition to the AEO2016 Reference case, Low Economic Growth and High Economic Growth cases were developed to reflect the uncertainty in projections of economic growth. The alternative cases are intended to show the effects of alternative growth assumptions on energy market projections. The cases are described as follows:

- In the Reference case, population grows by 0.7%/year, nonfarm employment by 0.7%/year, and productivity by 1.7%/ year from 2015 to 2040. Economic output as measured by real GDP increases by 2.2%/year from 2015 through 2040, and growth in real disposable income per capita averages 1.7%/year.
- The Low Economic Growth case assumes lower growth rates for population (0.6%/year) and productivity (1.3%/year), resulting in lower growth in nonfarm employment (0.6%/year), higher prices and interest rates, and lower growth in industrial output. In the Low Economic Growth case, economic output as measured by real GDP increases by 1.6%/year from 2015 through 2040, and growth in real disposable income per capita averages 1.4%/year.
- The High Economic Growth case assumes higher growth rates for population (0.8%/year) and productivity (2.0%/year), resulting in higher nonfarm employment (1.0%/year). With higher productivity gains and employment growth, inflation and interest rates are lower than in the Reference case, and consequently economic output grows at a higher rate (2.8%/year) than in the Reference case (2.2%/year). Real disposable income per capita grows by 2.0%/year.

Oil price cases

The benchmark oil price in AEO2016 is based on spot prices for North Sea Brent crude oil, which is an international standard for light sweet crude oil. The West Texas Intermediate (WTI) spot price is generally lower than the North Sea Brent price. EIA expects the price spread between Brent and WTI in the Reference, Low Oil Price, and High Oil Price cases to range between \$0/b and \$10/b and will continue to report WTI prices—a critical reference point for the value of growing production in the U.S. Midcontinent—as well as the imported refiner acquisition cost for crude oil. The December 2015 decision by the U.S. Congress to remove restrictions on U.S. crude oil exports also has the potential to narrow the spread between the Brent price and the price of domestic production streams under certain cases involving high levels of U.S. crude oil production [6].

The historical record shows substantial variability in oil prices, and there is arguably even more uncertainty about future prices in the long term. AEO2016 considers three oil price cases (Reference, Low Oil Price, and High Oil Price) to allow an assessment of alternative views on the future course of oil prices.

The Low and High Oil Price cases reflect a wide range of potential price paths, resulting from variation in global demand and supply of petroleum and other liquid fuels. The Low Oil Price case assumes conditions under which global liquids demand is low and supply is high; the High Oil Price case assumes the opposite. Both cases illustrate situations in which the shifts in global supply and demand are offsetting, so that liquids consumption is close to Reference case levels, but prices are substantially different.

- In the Reference case, real oil prices (2015 dollars) fall from \$52/b in 2015 to a low of \$37/b in 2016, before rising steadily to \$136/b in 2040. The Reference case represents a trend projection for both oil supply and demand. Global supply increases

Table E1. Summary of AEO2016 cases

Case name	Description	Reference in text	Reference in Appendix E
Reference	Real gross domestic product (GDP) grows at an average annual rate of 2.2% from 2015 to 2040. Brent crude oil prices rise to about \$136/barrel (b) (2015 dollars) in 2040. Complete projection tables in Appendix A.	--	--
Low Economic Growth	Real GDP grows at an average annual rate of 1.6% from 2015 to 2040. Other energy market assumptions are the same as in the Reference case. Partial projection tables in Appendix B.	p. MT-2	p. E-6
High Economic Growth	Real GDP grows at an average annual rate of 2.8% from 2015 to 2040. Other energy market assumptions are the same as in the Reference case. Partial projection tables in Appendix B.	p. MT-2	p. E-6
Low Oil Price	Low prices result from a combination of relatively low demand for petroleum and other liquids in the non-Organization for Economic Cooperative Development (non-OECD) nations and higher global supply. Lower demand occurs as a result of several factors: economic growth that is relatively slow compared with history; reduced consumption from the adoption of more efficient technologies, extension of the corporate average fuel economy (CAFE) standards, less travel demand, and increased natural gas or electricity use; efficiency improvement in nonmanufacturing in non-OECD countries; and industrial fuel switching from liquid to natural gas feedstocks for producing methanol and ammonia. On the supply side, both Organization of the Petroleum Exporting Countries (OPEC) and non-OPEC producers face lower costs of production for both crude oil and other liquids production technologies. However, lower-cost supply from OPEC producers eventually begins to crowd out supply from relatively more expensive non-OPEC sources. OPEC's market share of liquids production rises steadily from 39% in 2015 to 43% in 2020 and 47% in 2040. Light, sweet crude oil prices fall to an average of \$35/b (2015 dollars) in 2016, remain below \$50/b through 2030, and stay below \$75/b through 2040. Partial projection tables in Appendix C.	p. MT-3	p. E-8
High Oil Price	High prices result from a lack of global investment in the oil sector, eventually inducing higher production from non-OPEC producers relative to the Reference case. Higher prices stimulate increased supply from resource that are more expensive to produce—such as tight oil and bitumen, as well as increased production of renewable and synthetic fuels, compared with the Reference case. Increased non-OPEC production crowds out OPEC oil, and OPEC's share of world liquids production decreases, never exceeding the 41% reached in 2012 and dropping to 34% by the end of the projection. On the demand side, higher economic growth than in the Reference case, particularly in non-OECD countries, leads to increased demand: non-OECD consumers demand greater personal mobility and consumption of goods. There are also fewer efficiency gains throughout the industrial sector, and growing fuel needs in the nonmanufacturing sector continue to be met with liquid fuels, especially in response to policy shifts that force liquids to replace coal for chemical feedstock. Crude oil prices are about \$230/b (2015 dollars) in 2040. Partial projection tables in Appendix C.	p. MT-3	p. E-9
Extended Policies	The Extended Policies case begins with the Reference case and assumes extension of all existing tax credits (full credit values prior to phaseout are extended where phaseouts are scheduled) and policies that contain sunset provisions, except those requiring additional funding (e.g., loan guarantee programs). It also assumes an increase in capacity limitations on the investment tax credit (ITC) for combined heat and power, and extension of the program. The case includes an additional round of efficiency standards for residential and commercial products, as well as new standards for products not yet covered; adds multiple rounds of national building codes by 2034; and increases LDV and HDV fuel economy standards in the transportation sector. This case also includes the extension of EPA's Clean Power Plan regulations that reduce carbon dioxide emissions from electric power generation after 2030. Partial projection tables in Appendix D.	p. IF-22	p. E-9

Table E1. Summary of AEO2016 cases (continued)

Case name	Description	Reference in text	Reference in Appendix E
Oil and Gas: Low Oil and Gas Resource and Technology	Estimated ultimate recovery per shale gas, tight gas, and tight oil well in the United States and undiscovered resources in Alaska and the offshore lower 48 states are 50% lower than in the Reference case. Rates of technological improvement that reduce costs and increase productivity in the United States are also 50% lower than in the Reference case. All other assumptions remain the same as in the Reference case. Partial projection tables in Appendix D.	p. MT-29	p. E-11
Oil and Gas: High Oil and Gas Resource and Technology	Estimated ultimate recovery per shale gas, tight gas, and tight oil well in the United States, and undiscovered resources in Alaska and the offshore lower 48 states, are 50% higher than in the Reference case. Rates of technological improvement that reduce costs and increase productivity in the United States are also 50% higher than in the Reference case. In addition, tight oil and shale gas resources are added to reflect new plays or the expansion of known plays. All other assumptions remain the same as in the Reference case. Partial projection tables in Appendix D.	p. MT-29	p. E-11
Electricity: No CPP	Assumes that the Clean Power Plan (CPP) is not enforced, and that no federal requirements are in place to reduce carbon dioxide emissions from existing power plants.	p. IF-3	p. E-10
Electricity: CPP Rate	Assumes that CPP compliance is met through regional rate-based (pounds/MWh) standards that, on average, affect all generation within the region.	p. IF-3	p. E-10
Electricity: CPP Interregional Trading	Assumes that CPP compliance is met through regional mass-based caps, including new sources, and allows trading of carbon allowances between regions within the Eastern Interconnect and within the Western Interconnect.	p. IF-3	p. E-10
Electricity: CPP Extended	Assumes that the CPP CO ₂ emissions targets continue to decline after 2030, reaching a 45% reduction below 2005 levels in 2040.	p. IF-4	p. E-10
Electricity: CPP Hybrid	Assumes that regions can vary their CPP compliance method, with the Northeast and CA regions choosing mass-based caps and the remaining regions using average rate-based standards.	p. IF-4	p. E-10
Electricity: CPP Allocation to Generators	Assumes the same CPP compliance as in the Reference case, except that the carbon allowances are allocated to generators instead of being allocated to load entities, resulting in higher retail price impacts.	p. IF-4	p. E-10
Energy Efficiency Case for Manufacturing Industries with Technology Choice	Assuming Reference case prices and economic conditions, examines the effects of more aggressive adoption of energy-efficient technologies and rapid improvement in energy intensity on manufacturers in five industries (cement and lime, aluminum, glass, iron and steel, and paper).	p. IF-36	p. E-9
Industrial Efficiency Low Incentive	Uses a price on CO ₂ emissions as a proxy for higher energy costs, as a way to increase energy efficiency in all industries except refining. A CO ₂ price is phased in gradually, starting in 2018, reaches \$12.50/metric ton in 2023, and increases by 5% per year thereafter.	p. IF-35	p. E-9
Industrial Efficiency High Incentive	As in the Industrial Efficiency Low Incentive case, with the only difference being that the CO ₂ price is \$35.00/metric ton in 2023.	p. IF-35	p. E-9
Phase 2 Standards	Assumes improvements to medium- and heavy-duty vehicle technologies while increasing the number of technologies from 37 to 70. Restructures the current 13 vehicle size classes and incorporates an additional size class, bringing the total to 14 size classes.	p. IF-16	p. E-10

through the medium-term (although it does slow from 2020–25) and is limited by geopolitical constraints rather than by resource availability. Global petroleum and other liquids consumption increases steadily throughout the Reference case, in part because of an increase in the number of vehicles across the world, which is offset somewhat by improvements in LDV and HDV fuel economy in developing countries, as well as increased natural gas use for transportation in most regions. Economic growth is steady over the projection period, and there is some substitution away from liquids fuels in the industrial sector.

- In the Low Oil Price case, crude oil prices fall to an average of \$35/b (2015 dollars) in 2016, remain below \$50/b through 2030, and stay below \$75/b through 2040. Relatively low demand compared to the Reference case occurs as a result of several factors: economic growth that is relatively slow compared to history; reduced consumption in developed countries resulting from the adoption of more efficient technologies, extended CAFE standards, less travel demand, and increased use of natural

gas or electricity; efficiency improvement in nonmanufacturing industries in the non-OECD countries; and industrial fuel switching from liquids to natural gas feedstocks for production of methanol and ammonia. Low oil prices also result from lower costs of production and relatively abundant supply from both OPEC and non-OPEC producers. However, lower-cost supply from OPEC producers eventually begins to crowd out supply from relatively more expensive non-OPEC sources. In the Low Oil Price case, OPEC's market share of liquids production rises steadily from 39% in 2015 to 43% in 2020 and to 47% in 2040.

- In the High Oil Price case, oil prices average about \$230/b (2015 dollars) in 2040. A lack of global investment in the oil sector is the primary cause of higher prices, which eventually lead to higher production from non-OPEC producers relative to the Reference case. Higher prices stimulate increased supply of more costly resources, including tight oil and bitumen, and also lead to significant increases in production of renewable liquid fuels as well as GTL and CTL compared with the Reference case. Increased non-OPEC production crowds out OPEC oil, and OPEC's share of world liquids production decreases, never exceeding the 41% share reached in 2012 and dropping to 34% in 2040. The main reason for increased demand in the High Oil Price case is higher economic growth, particularly in developing countries, than in the Reference case. In the developing countries, consumers demand greater personal mobility and more consumption of goods. There are fewer efficiency gains in the industrial sector, while growing demand for fuel in the non-manufacturing sector continues to be met with liquid fuels, and policy shifts result in the replacement of chemical feedstocks by coal.

Buildings sector cases

The Extended Policies case includes assumptions in the NEMS Residential and Commercial Demand Modules. The Extended Policies case extends federal incentives that have a specific sunset date in current law and adds an additional round of appliance standards and multiple rounds of building codes, as described below.

- The Extended Policies case assumes that selected federal policies with sunset provisions are extended indefinitely at current levels rather than being allowed to sunset as the law currently prescribes. For the residential sector, personal tax credits are extended at the 30% level through 2040 for solar photovoltaics installations, solar water heaters, small wind turbines, and geothermal heat pumps. For residential solar equipment, tax credits are extended at the 30% level instead of being phased out completely as specified by current law. For the commercial sector, the ITC for solar technologies, small wind turbines, geothermal heat pumps, and combined heat and power is extended at the 30% level through 2040. The business tax credit for solar technologies remains at the 30% level through 2040 instead of being phased down to 10%. The Extended Policies case includes updates to federal appliance standards, as prescribed by the timeline in the Department of Energy's (DOE) multiyear plan, and introduces new standards for products currently not covered by DOE. Efficiency levels for the updated residential appliance standards are based on current ENERGY STAR guidelines or "mid-level" efficiencies where ENERGY STAR guidelines are not available. End-use technologies eligible for extended incentives are not subject to new standards. Efficiency levels for updated commercial equipment standards are based on the technology menu from the AEO2016 Reference case and purchasing specifications for federal agencies designated by the Federal Energy Management Program. The Extended Policies case also adds two additional rounds of improved national building codes with implementation beginning in 2025 and 2034, each phased in over nine years.

Industrial sector cases

In addition to the AEO2016 Reference case, three technology-focused cases were developed, using the Industrial Demand Module (IDM) to examine the effects of less rapid and more rapid technology change and adoption in the industrial sector. The energy intensity changes discussed in this section exclude the refining industry, which is modeled separately from the IDM in the Liquid Fuels Market Module. The technology cases are described as follows:

- The Energy Efficiency Case for Manufacturing Industries with Technology Choice case examines the effects of efficiency improvements made over time by manufacturers in the five process flow industries (cement and lime, aluminum, glass, iron and steel, and paper), which can change the mix of technologies chosen relative to the Reference Case. Prices and economic conditions are the same as in the Reference case. The energy efficiency increases are based on research by Lawrence Berkeley National Laboratory related to best practice energy intensity [7], and on Bandwidth Analysis by DOE [8]. This case includes more aggressive adoption of energy-efficient technologies and more rapid improvement in the energy intensity of some future technology choices that currently are not being used.
- The Industrial Efficiency Low Incentive case examines the effects of a price on carbon emissions on energy efficiency in the industrial sector. This case includes all industries in the industrial sector except refining. It assumes a price on CO₂ emissions, as a proxy for higher energy costs, stimulating an increase in energy efficiency. The CO₂ price is phased in gradually, starting in 2018, rises to \$12.50/metric ton in 2023, and thereafter increases by 5%/year through 2040. The higher energy costs create an incentive to reduce fuel costs by increasing the efficiencies of existing technologies, adopting more energy efficient technologies, and switching to less carbon-intensive fuels.
- The Industrial Efficiency High Incentive case uses the same approach as the Industrial Efficiency Low Incentive case but assumes a higher price on CO₂ emissions, starting in 2018, increasing gradually to \$35.00/metric ton in 2023, and increasing thereafter increases by 5%/year. The higher energy costs increase the incentive to increase efficiency and use less carbon-intensive fuels, leading to greater efficiency improvement than in the Reference and Industrial Efficiency Low Incentive cases.

- The Extended Policies case described below is a cross-cutting integrated case that involves making changes in a number of NEMS models. The Extended Policies case modifies selected industrial assumptions from the Reference case, assuming that the existing 10% Investment Tax Credit (ITC) for industrial CHP is extended through 2040, modifying capacity limitations on the ITC by increasing the cap on CHP equipment from 15 MW to 25 MW, and eliminating the system-wide cap of 50 MW. These assumptions are based on the proposals made in H.R. 2750 and H.R. 2784 of the 112th Congress.

Transportation sector cases

In addition to the AEO2016 Reference case, the NEMS Transportation Demand Module was used as part of two AEO2016 alternative cases.

In the Extended Policies case, the Transportation Demand Module was used to examine the effects of extending LDV GHG emissions and CAFE standards beyond 2025, with the joint EPA/NHTSA CAFE Standards increasing after 2025, at an average annual rate of 1.3% through 2040, to a combined average LDV fuel economy compliance of 56.8 mpg in 2040. As part of the Extended Policies case, the Transportation Demand Module was also used to examine the effects of extending the HDV fuel efficiency and GHG emissions standards to reflect requirements under the Phase 2 Standards proposal. The regulations are currently specified for model years 2014 through 2018. The Extended Policies case includes a modest increase in fuel consumption and GHG emissions standards for 13 HDV size classes.

Assumptions in the NEMS Transportation Demand Module were modified for the Phase 2 Standards case, which examines the effects of the EPA/NHTSA jointly proposed GHG emissions and fuel efficiency standards for medium- and heavy-duty vehicles. The Phase 2 Standards case includes assumptions of improved technology options for medium- and heavy-duty vehicles by replacing and increasing the number of technologies from 37 to 70. The Phase 2 Standards case also includes restructured and updated vehicle size classes that increase the size classes from 13 to 14.

Electricity sector cases

While the Reference case includes one potential implementation of the CPP, there are uncertainties related to the options that states will use to comply with the rule. The rule is also being challenged in court, and the Supreme Court has stayed enforcement of the rule until legal challenges are resolved. To date, the rule has not been vacated or affirmed by any lower court ruling. Therefore, several integrated cases assuming alternate paths to meeting the CPP were developed to support discussions in the Market Trends and Issues in Focus section of AEO2016. A case was also developed assuming that the CPP is not implemented. The Issues in Focus article, "Effects of the Clean Power Plan," discusses the impacts of the CPP under different implementations relative to the mass-based standards assumed in the Reference case, and relative to the case without any CPP enforcement.

Clean Power Plan cases

- The No CPP case assumes that the CPP is completely vacated and is not enforced, implying that states have no federal requirement to reduce CO₂ emissions from existing power plants. There are no constraints imposed in the electricity model to reach regional rate-based or mass-based carbon dioxide targets (other than programs already in place, such as the Regional Greenhouse Gas Initiative (RGGI) and AB 32. There is no incentive for incremental energy efficiency in the end-use demand modules.
- The CPP Rate case assumes that all regions choose to comply with the CPP by meeting average rate-based emissions goals (pounds/MWh) within each Electricity Market Module region, without cooperation across regions. That is, each region has a specific average emission rate that must be met by the affected generation in the region.
- The CPP Interregional Trading case assumes that all regions choose to meet mass-based goals, covering existing and new sources (as in the Reference case), but with trading of carbon allowances between regions within the Eastern and Western Interconnects. In this case, regions that reduce emissions more than needed to meet their own regional caps may trade their excess allowances with other regions, allowing those regions to emit more than their caps.
- The CPP Extended case further reduces the CO₂ targets after 2030 instead of maintaining a constant standard. This case assumes that the mass-based limits in 2030, which will result in power sector CO₂ emissions that are about 35% below 2005 levels, continue to decline linearly to achieve a 45% reduction below 2005 levels in 2040. The post-2030 reductions are applied using the same rate of decline for each state.
- The CPP Hybrid case assumes that regions in which programs enforcing carbon caps are already in place (RGGI in the Northeast [9] and AB 32 in California) comply with the CPP through a mass-based goal, but that states in other regions implement the CPP using a rate-based approach. This case assumes no interregional trading for CPP compliance.
- The CPP Allocation to Generators case assumes that all regions meet mass-based caps including new sources (as in the Reference case), but that the carbon allowances are freely allocated to generators, rather than to load-serving entities. In this case, it is assumed that generators in competitive regions will continue to include the value of allowances in their operating costs and, as a result, that marginal generation costs will reflect the costs of allowances. The Reference case assumes that the allowances are allocated to load-serving entities, which then refund the revenue from the allowance sales to consumers through lower distribution prices. The CPP Allocation to Generators case assumes no reduction in distribution costs, resulting in prices that are higher than those in the Reference case and showing the impact of allowance allocation alternatives on retail prices.

Extended Policies case

The Reference case includes the CPP, which under current regulations is phased in over the 2022–30 period, and assumes that states comply by setting mass-based compliance strategies that cover both existing and new electric generators. The Extended Policies case assumes a further reduction in CO₂ targets after 2030. The mass-based limits, which in the Reference case result in power sector CO₂ emissions that are 35% below 2005 levels in 2030, are assumed to continue declining linearly to 45% below 2005 levels in 2040.

Renewable fuels cases

AEO2016 also includes an Extended Policies case to examine the effects of indefinite extension of expiring federal tax credits for renewable electricity generation plants. In the Extended Policies case, the full tax credit of 2.3 cents/kWh (adjusted annually for inflation) is extended permanently beyond 2017 for new wind and geothermal generators and is available for the first 10 years of production. A tax credit of 1.1 cents/kWh, also available for the first 10 years of production, is extended indefinitely to new generators using landfill gas, certain hydroelectric technologies, and biomass fuels. (Open-loop biomass is assumed to be the predominant source of biomass fuel over the projection period.) Furthermore, this case maintains the permanent availability of the 30% ITC (the ITC's value prior to phaseout) for new generators using solar energy.

Oil and natural gas supply cases

The sensitivity of the AEO2016 projections to changes in assumptions regarding technically recoverable domestic crude oil and natural gas resources is examined in two cases. These cases do not represent a confidence interval for future domestic oil and natural gas supply, but rather provide a framework to examine the effects of higher and lower domestic supply on energy demand, imports, and prices. Assumptions associated with the two cases are described below.

- In the Low Oil and Gas Resource and Technology case, the estimated ultimate recovery per tight oil, tight gas, or shale gas well in the United States and undiscovered resources in Alaska and the offshore lower 48 states are assumed to be 50% lower than in the Reference case. Rates of technology improvement that reduce costs and increase productivity in the United States also are 50% lower than in the Reference case. These assumptions increase the per-unit cost of crude oil and natural gas development in the United States. The total unproved technically recoverable resource of crude oil is decreased to 150 billion barrels, and the natural gas resource is decreased to 1,303 trillion cubic feet (Tcf), as compared with unproved resource estimates of 238 billion barrels of crude oil and 2,136 Tcf of natural gas as of January 1, 2014, in the Reference case.
- In the High Oil and Gas Resource and Technology case, the resource assumptions are adjusted to allow a continued increase in domestic crude oil production through 2040, to 18 million barrels per day (b/d) compared with 11 million b/d in the Reference case. This case includes: (1) 50% higher estimated ultimate recovery per tight oil, tight gas, or shale gas well, as well as additional unidentified tight oil and shale gas resources to reflect the possibility that additional layers or new areas of low-permeability zones will be identified and developed; (2) diminishing returns on the estimated ultimate recovery once drilling levels in a county exceed the number of potential wells assumed in the Reference case, to reflect well interference at greater drilling density; (3) 50% higher assumed rates of technological improvement that reduce costs and increase productivity in the United States relative to the Reference case; and (4) 50% higher technically recoverable undiscovered resources in Alaska and the offshore lower 48 states than in the Reference case. The total unproved technically recoverable resource of crude oil increases to 385 billion barrels, and the natural gas resource increases to 3,109 Tcf as compared with unproved resource estimates of 238 billion barrels of crude oil and 2,136 Tcf of natural gas in the Reference case as of the start of 2014.

Extended Policies case

In addition to the AEO2016 Reference case, the AEO2016 Extended Policies case assumes the extension of all existing tax credits and policies that contain sunset provisions at current levels, except those requiring additional funding (e.g., loan guarantee programs). The Extended Policies case also assumes an increase in the capacity limitations on the ITC for CHP, and extension of the program. It includes an additional round of federal efficiency standards for residential and commercial products, as well as new standards for products not yet covered; adds multiple rounds of national building codes by 2034; and increases LDV and HDV fuel economy standards in the transportation sector. The Extended Policies case also assumes continued tightening of EPA's Clean Power Plan regulations that reduce carbon dioxide emissions from electric power generation after 2030. Specific assumptions for each end-use sector and for renewables are described in the sector-specific sections above.

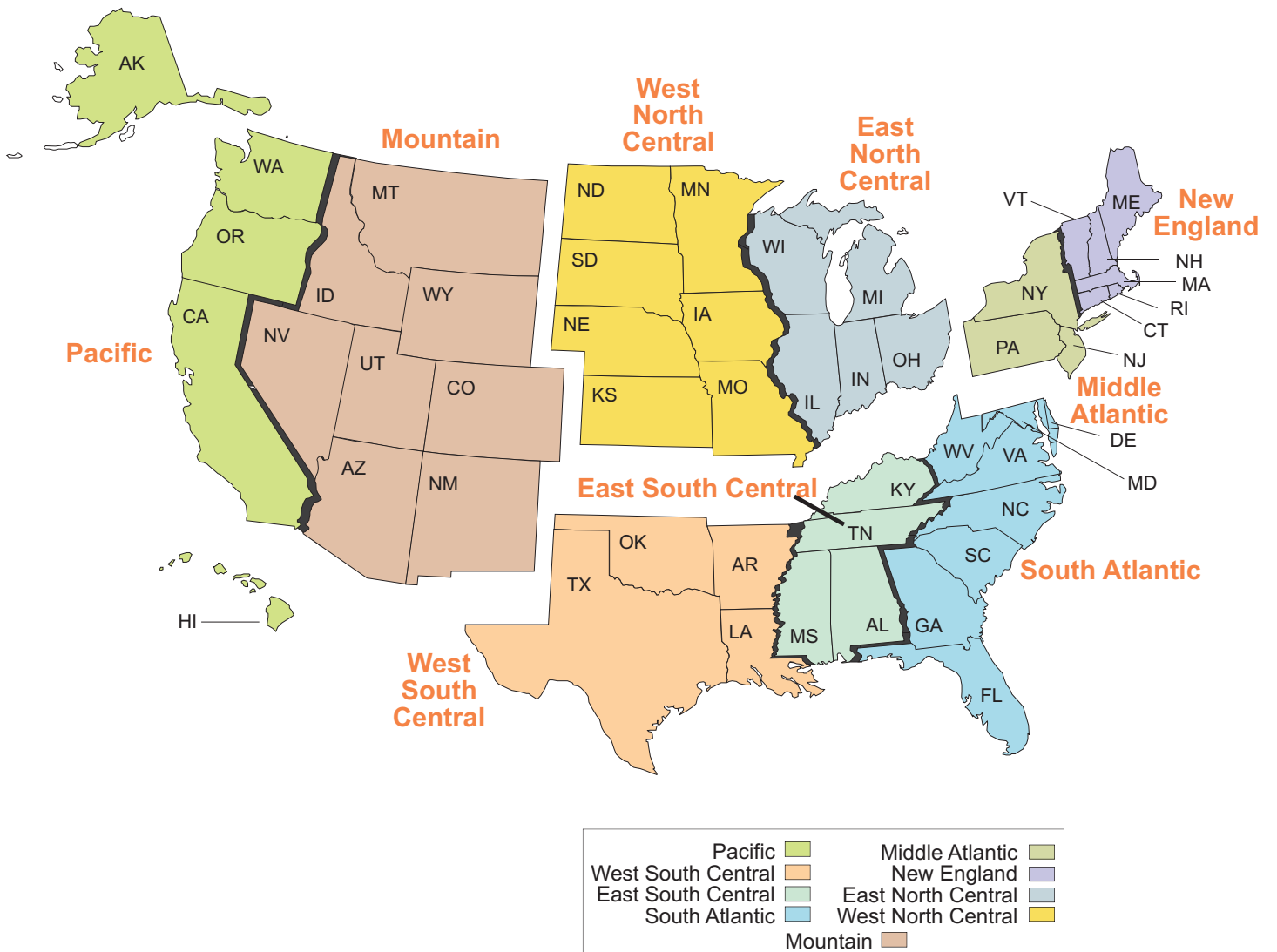
Endnotes for Appendix E

Links current as of July 2016

1. U.S. Energy Information Administration, *The National Energy Modeling System: An Overview 2009*, DOE/EIA-0581(2009) (Washington, DC: October 2009), <http://www.eia.gov/oiaf/aeo/overview>.
2. Selected EIA publications used for data sources include: *Short-Term Energy Outlook*, *Monthly Energy Review*, *Natural Gas Annual*, *Natural Gas Monthly*, *Electric Power Monthly*, *Electric Power Annual*, *Annual Coal Report*, *Petroleum Supply Annual*, and *Quarterly Coal Report*, as well as EIA surveys.
3. U.S. Energy Information Administration, *Short-Term Energy Outlook* (Washington, DC: February 2016), <http://www.eia.gov/forecasts/steo/outlook.cfm>.
4. U.S. Energy Information Administration, *Assumptions to the Annual Energy Outlook 2016*, DOE/EIA-0554(2016) (Washington, DC: forthcoming Fall 2016), <http://www.eia.gov/forecasts/aeo/assumptions>.
5. U.S. Energy Information Administration, *Effects of Removing Restrictions on U.S. Crude Oil Exports* (Washington, DC: September 2015), <http://www.eia.gov/analysis/requests/crude-exports/>.
6. U.S. Energy Information Administration, *Effects of Removing Restrictions on U.S. Crude Oil Exports* (Washington, DC: September 2015), <http://www.eia.gov/analysis/requests/crude-exports/>.
7. E. Worrell, L. Price, M. Neelis, C. Galitsky, and Z. Nan, *World Best Practice Energy Intensity Values for Selected Industrial Sectors*, LBNL-62806, Rev. 2 (Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, CA: February 2008), https://eaei.lbl.gov/sites/all/files/industrial_best_practice_en.pdf.
8. D.M. Rue, J. Servaites, and W. Wolfe, *Final Report: Industrial Glass Bandwidth Analysis* (Gas Technology Institute, Des Plaines, IL: August 2007), http://www.energy.gov/sites/prod/files/2013/11/f4/industrial_bandwidth.pdf.
9. The CPP Hybrid case assumes that the New York and New England electricity regions use mass-based compliance. Delaware and Maryland are also members of RGGI; however, those states are part of a larger electricity modeling region including states that are not part of RGGI, and they represent a relatively small share of the overall region's emissions. Because CPP compliance is modeled by electricity model region, not by state, the CPP Hybrid case assumes that the region that includes Delaware and Maryland complies by using a rate-based approach.

Appendix F Regional Maps

Figure F1. United States Census Divisions



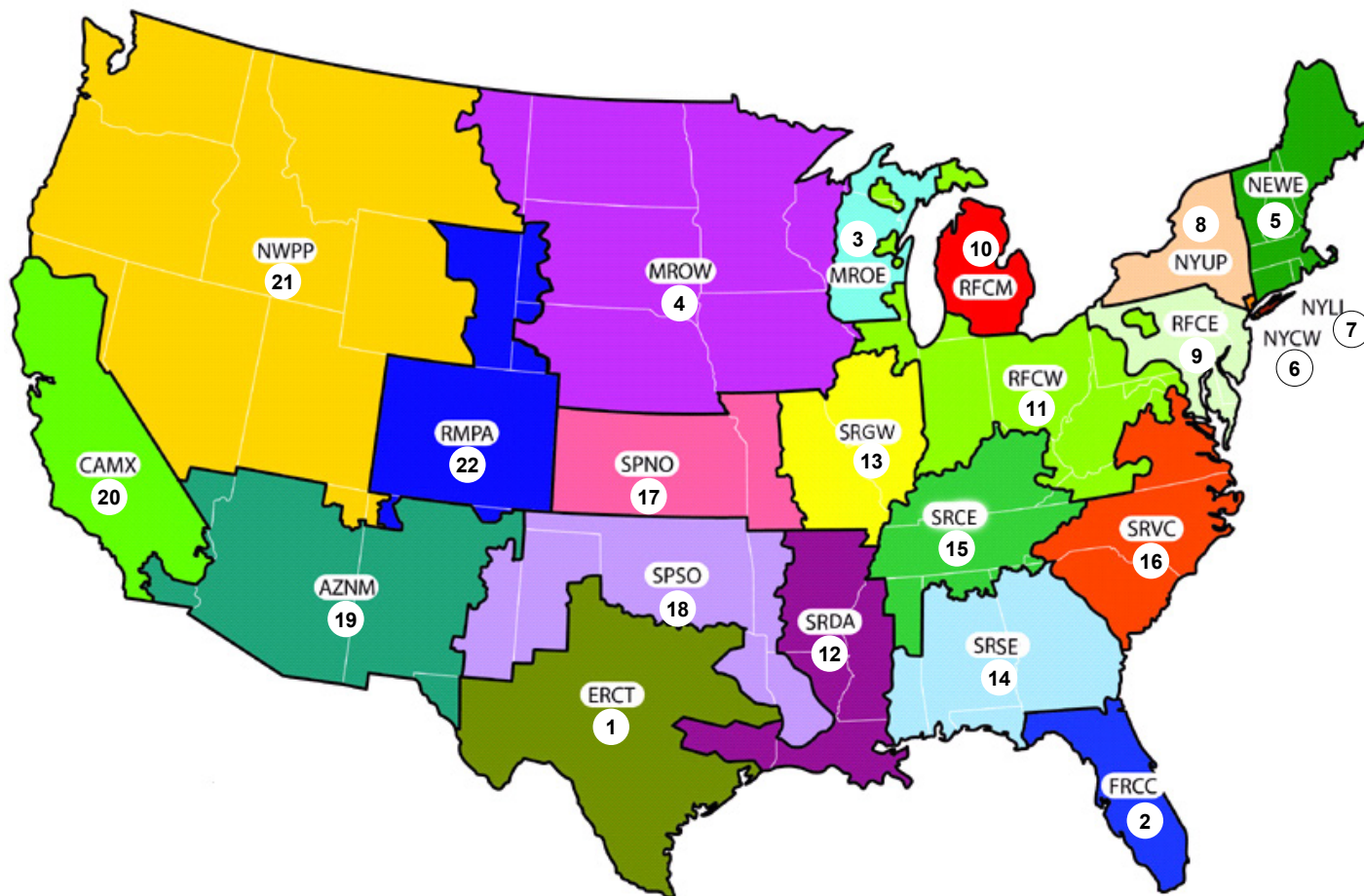
Source: U.S. Energy Information Administration, Office of Energy Analysis.

Figure F1. United States Census Divisions (continued)

<u>Division 1</u> New England	<u>Division 3</u> East North Central	<u>Division 5</u> South Atlantic	<u>Division 7</u> West South Central	<u>Division 9</u> Pacific
Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont	Illinois Indiana Michigan Ohio Wisconsin	Delaware District of Columbia Florida Georgia Maryland North Carolina South Carolina Virginia West Virginia	Arkansas Louisiana Oklahoma Texas	Alaska California Hawaii Oregon Washington
<u>Division 2</u> Middle Atlantic	<u>Division 4</u> West North Central	<u>Division 6</u> East South Central	<u>Division 8</u> Mountain	
New Jersey New York Pennsylvania	Iowa Kansas Minnesota Missouri Nebraska North Dakota South Dakota	Alabama Kentucky Mississippi Tennessee	Arizona Colorado Idaho Montana Nevada New Mexico Utah Wyoming	

Source: U.S. Energy Information Administration, Office of Energy Analysis.

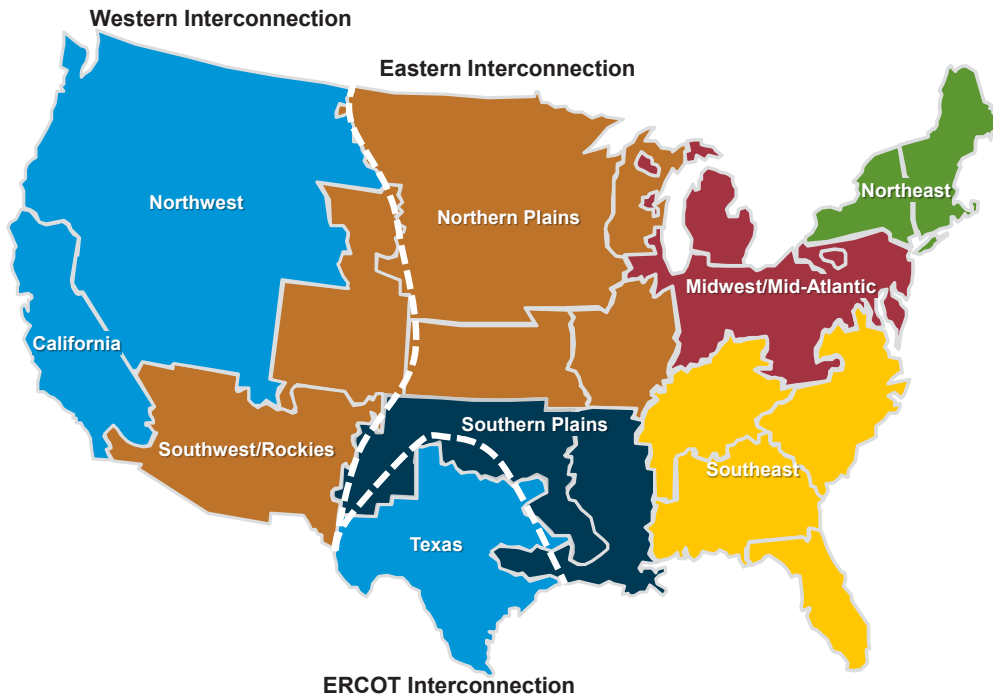
Figure F2. Electricity market module regions



1. ERCT	TRE All	12. SRDA	SERC Delta
2. FRCC	FRCC All	13. SRGW	SERC Gateway
3. MROE	MRO East	14. SRSE	SERC Southeastern
4. MROW	MRO West	15. SRCE	SERC Central
5. NEWE	NPCC New England	16. SRVC	SERC VACAR
6. NYCW	NPCC NYC/Westchester	17. SPNO	SPP North
7. NYLI	NPCC Long Island	18. SPSO	SPP South
8. NYUP	NPCC Upstate NY	19. AZNM	WECC Southwest
9. RFCE	RFC East	20. CAMX	WECC California
10. RFCM	RFC Michigan	21. NWPP	WECC Northwest
11. RFCW	RFC West	22. RMPA	WECC Rockies

Source: U.S. Energy Information Administration, Office of Energy Analysis.

Figure F3. North American Electric Reliability Corporation regions

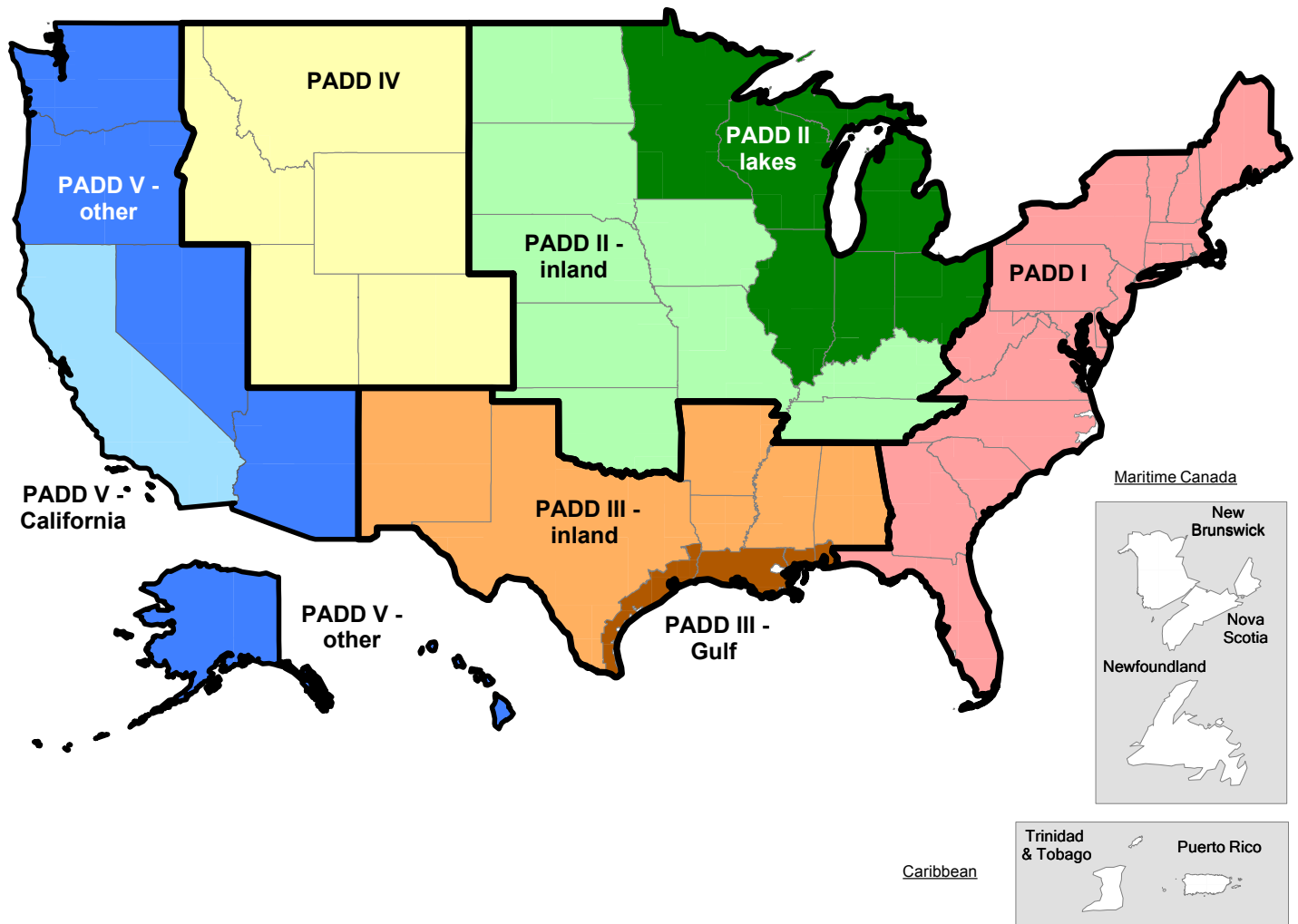


Mapping for aggregated electricity regions

Aggregate region	EMM regions included in aggregate region		
Northeast	5	NEWE	Northeast Power Coordinating Council (NPCC) / New England
Northeast	6	NYCW	NPCC / New York City-Westchester
Northeast	7	NYLI	NPCC/ Long Island
Northeast	8	NYUP	NPCC/ Upstate New York
Midwest/Mid-Atlantic	9	RFCE	ReliabilityFirst Corporation-East
Midwest/Mid-Atlantic	10	RFCM	ReliabilityFirst Corporation-Michigan
Midwest/Mid-Atlantic	11	RFCW	ReliabilityFirst Corporation-West
Southeast	2	FRCC	Florida Reliability Coordinating Council
Southeast	14	SRSE	SERC Reliability Corporation (SERC)/Southeastern
Southeast	15	SRCE	SERC/ Central
Southeast	16	SRVC	SERC/ Virginia-Carolina
Southern Plains	12	SRDA	SERC/ Delta
Southern Plains	18	SPSO	Southwest Power Pool Regional Entity / South
Texas	1	ERCT	Texas Reliability Entity
Southwest/Rockies	19	AZNM	Western Electricity Coordinating Council (WECC)/Arizona New Mexico
Southwest/Rockies	22	RMPA	WECC/ Rockies
California	20	CAMX	WECC/ California
Northwest	21	NWPP	WECC/ Northwest Power Pool Area
Northern Plains	3	MROE	Midwest Reliability Organization-East
Northern Plains	4	MROW	Midwest Reliability Organization-West
Northern Plains	13	SRGW	SERC/ Gateway
Northern Plains	17	SPNO	Southwest Power Pool Regional Entity / North

Notes: Names of grouped regions are intended to be approximately descriptive of location. Exact regional boundaries do not necessarily correspond to state borders or to other regional naming conventions. Aggregate region data are summed or averaged over the electricity model regions listed.

Figure F4. Liquid fuels market module regions



▣ PADD boundary

LFMM regions

- | | | |
|--|---|--|
| ■ PADD I | ■ PADD III Gulf | ■ PADD V California |
| ■ PADD II inland | ■ PADD III inland | ■ PADD V other |
| ■ PADD II lakes | ■ PADD IV | ■ Maritime Canada; Caribbean |

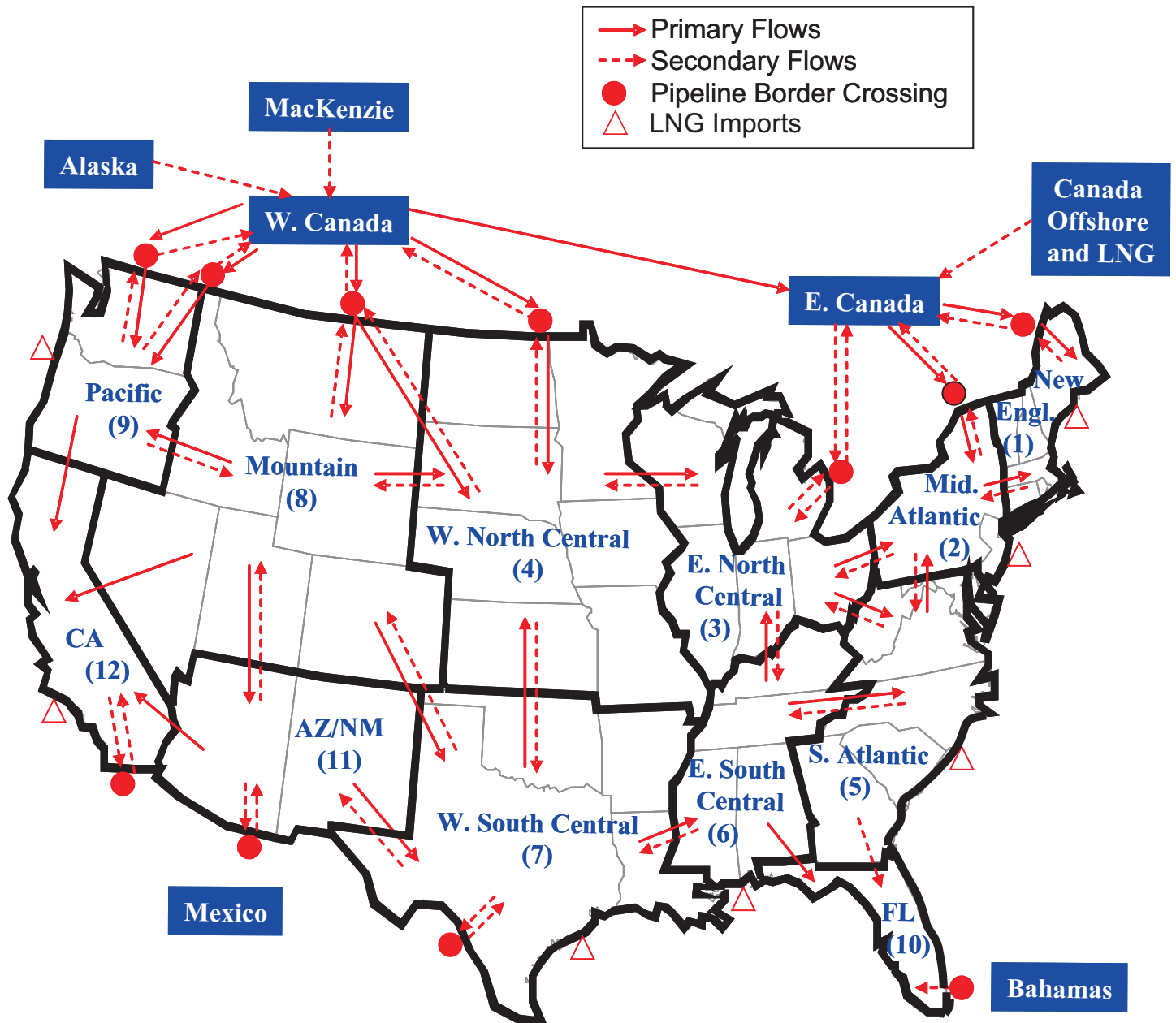
Source: U.S. Energy Information Administration, Office of Energy Analysis.

Figure F5. Oil and gas supply model regions



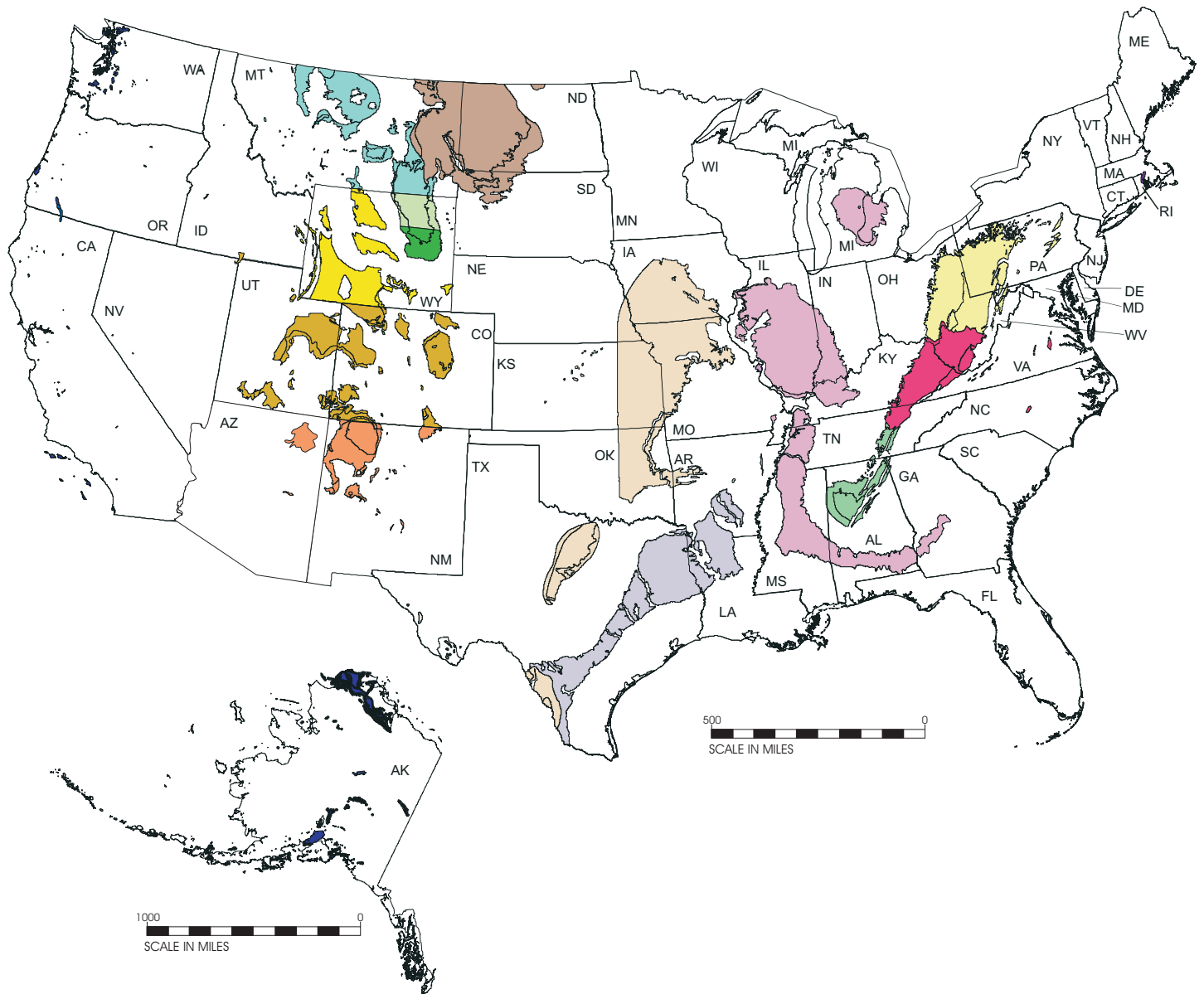
Source: U.S. Energy Information Administration, Office of Energy Analysis.

Figure F6. Natural gas transmission and distribution model regions



Source: U.S. Energy Information Administration, Office of Energy Analysis.

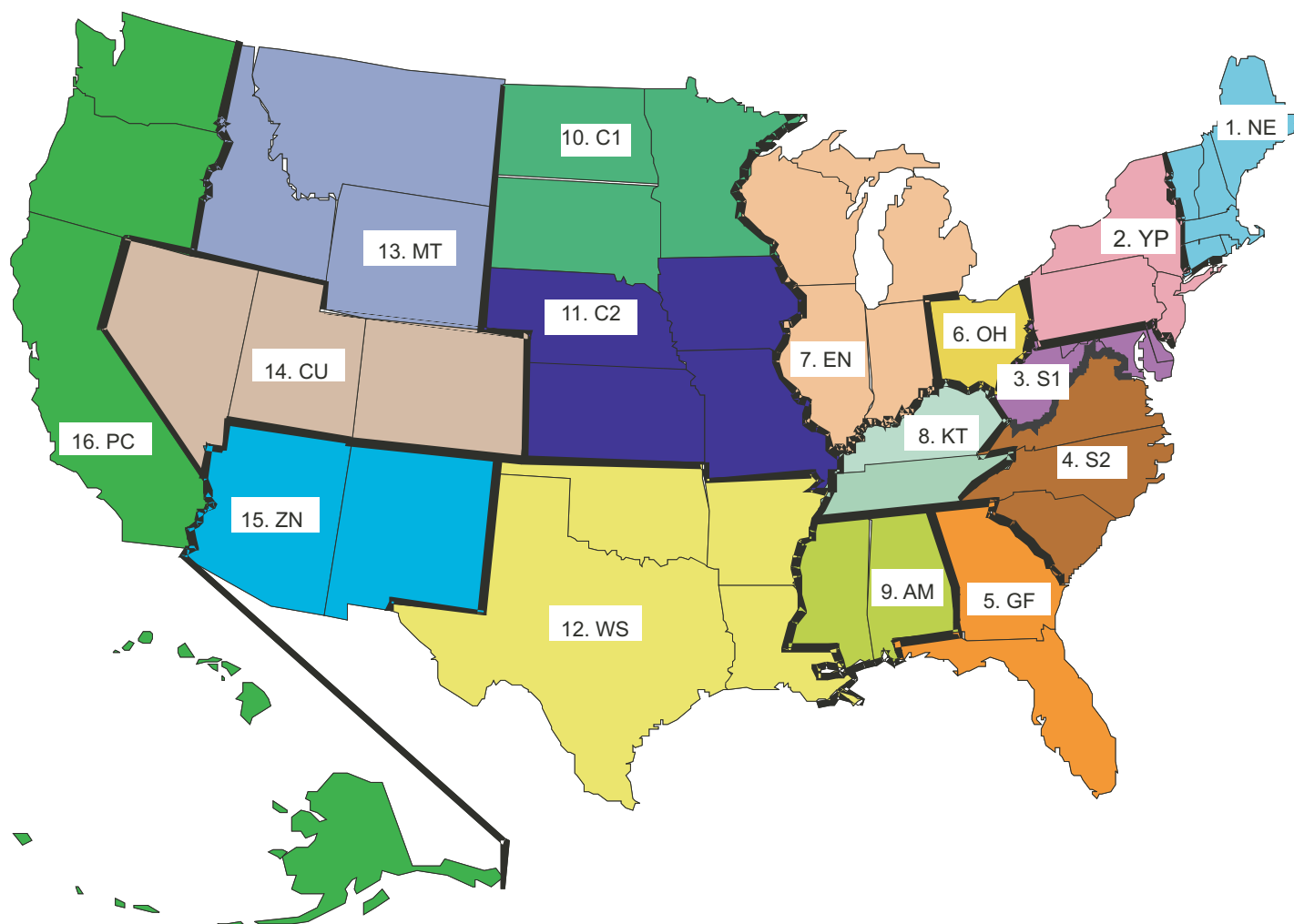
Figure F7. Coal supply regions



- | | | | |
|---|--|--|---|
| APPALACHIA | | NORTHERN GREAT PLAINS | |
| Northern Appalachia | Dakota Lignite | Wyoming, Northern Powder River Basin | Western Wyoming |
| Central Appalachia | Wyoming, Southern Powder River Basin | | |
| Southern Appalachia | | | |
| INTERIOR | | OTHER WEST | |
| Eastern Interior | Rocky Mountain | Northwest | |
| Western Interior | | | |
| Gulf Lignite | | | |

Source: U.S. Energy Information Administration, Office of Energy Analysis.

Figure F8. Coal demand regions



Region Code	Region Content
1. NE	CT,MA,ME,NH,RI,VT
2. YP	NY,PA,NJ
3. S1	WV,MD,DC,DE
4. S2	VA,NC,SC
5. GF	GA,FL
6. OH	OH
7. EN	IN,IL,MI,WI
8. KT	KY,TN

Region Code	Region Content
9. AM	AL,MS
10. C1	MN,ND,SD
11. C2	IA,NE,MO,KS
12. WS	TX,LA,OK,AR
13. MT	MT,WY,ID
14. CU	CO,UT,NV
15. ZN	AZ,NM
16. PC	AK,HI,WA,OR,CA

Source: U.S. Energy Information Administration, Office of Energy Analysis.

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix G

Conversion factors

Table G1. Heat contents

Fuel	Units	Approximate heat content
Coal¹		
Production	million Btu per short ton	20.02
Consumption	million Btu per short ton	19.49
Coke plants	million Btu per short ton	28.69
Industrial ²	million Btu per short ton	20.73
Commercial and institutional	million Btu per short ton	23.11
Electric power sector ³	million Btu per short ton	19.04
Imports.....	million Btu per short ton	22.73
Exports	million Btu per short ton	26.21
Coal coke	million Btu per short ton	24.80
Crude oil¹		
Production	million Btu per barrel	5.719
Imports.....	million Btu per barrel	6.063
Petroleum products and other liquids		
Consumption ¹	million Btu per barrel	5.148
Motor gasoline ¹	million Btu per barrel	5.057
Jet fuel.....	million Btu per barrel	5.670
Distillate fuel oil ¹	million Btu per barrel	5.778
Diesel fuel ¹	million Btu per barrel	5.778
Residual fuel oil	million Btu per barrel	6.287
Liquefied petroleum gases and other ^{1,4} ...	million Btu per barrel	3.559
Kerosene	million Btu per barrel	5.670
Petrochemical feedstocks ¹	million Btu per barrel	5.441
Unfinished oils ¹	million Btu per barrel	6.111
Imports ¹	million Btu per barrel	5.518
Exports ¹	million Btu per barrel	5.398
Ethanol, including denaturant	million Btu per barrel	3.558
Biodiesel	million Btu per barrel	5.359
Natural gas plant liquids¹		
Production	million Btu per barrel	3.745
Natural gas¹		
Production, dry	Btu per cubic foot	1,031
Consumption	Btu per cubic foot	1,031
End-use sectors.....	Btu per cubic foot	1,032
Electric power sector ³	Btu per cubic foot	1,029
Imports.....	Btu per cubic foot	1,025
Exports	Btu per cubic foot	1,009
Electricity consumption	Btu per kilowatthour	3,412

¹Conversion factor varies from year to year. The value shown is for 2015.

²Includes combined heat and power plants that have a non-regulatory status, and small on-site generating systems.

³Includes all electricity-only and combined heat and power plants that have a regulatory status.

⁴Includes ethane, natural gasoline, and refinery olefins.

Btu = British thermal unit.

Sources: U.S. Energy Information Administration, *Short-Term Energy Outlook*, February 2016 and EIA, AEO2016 National Energy Modeling System run ref2016.d032416a.

THIS PAGE INTENTIONALLY LEFT BLANK