Natural Gas Value Chain: Discussion Questions

********** Day 2 **********

********** Session 2, Session 3 – 11:45 and 1:45 **********

Electric Generation

- What other generation fuels are in the mix?
- Characteristics of different types of generation
- Which are growing and which are being phased out? Why?
    - What are the alternatives for new generation?
    - What dual-fuel capabilities?
- What is the ownership of generation?
- Where would generation be located?
    - Given value considerations above, would you locate near wellhead? Near load?
- Will gas-fired generation be served through the same pipeline and distribution systems as other customers?
    - What competing uses?
    - How do the peaks align?
    - How much "firm" usage do generators require? How is "firm" defined?
    - Can other uses be added to a dedicated generation gas system at a later time?
- Who is responsible for forecasting?
    - For electric load?
    - For gas load?
    - How reliable are the forecasts?
    - Who will coordinate reliability between the gas and electric systems?

        - How does the gas system rely on electricity?
        - How much can the electricity system depend on natural gas
- Would using gas for electric generation drive prices up or down for other users?

Purposes of regulation

- Price? Quality? Access? Security?
- Possible Public Interest Objectives
    - Investment
    - Profit Control
    - Rate Control
    - Universal Service
    - Rate Fairness
    - Quality of Service
    - Reliability
    - Safety
    - Use of Public Land
    - Taking of Private Land
    - Complaints
    - Energy Efficiency
    - Economic Development

What public policy is in the Law?

- What “job description” does the Law give regulators?
- What regulatory tools does the regulator have?

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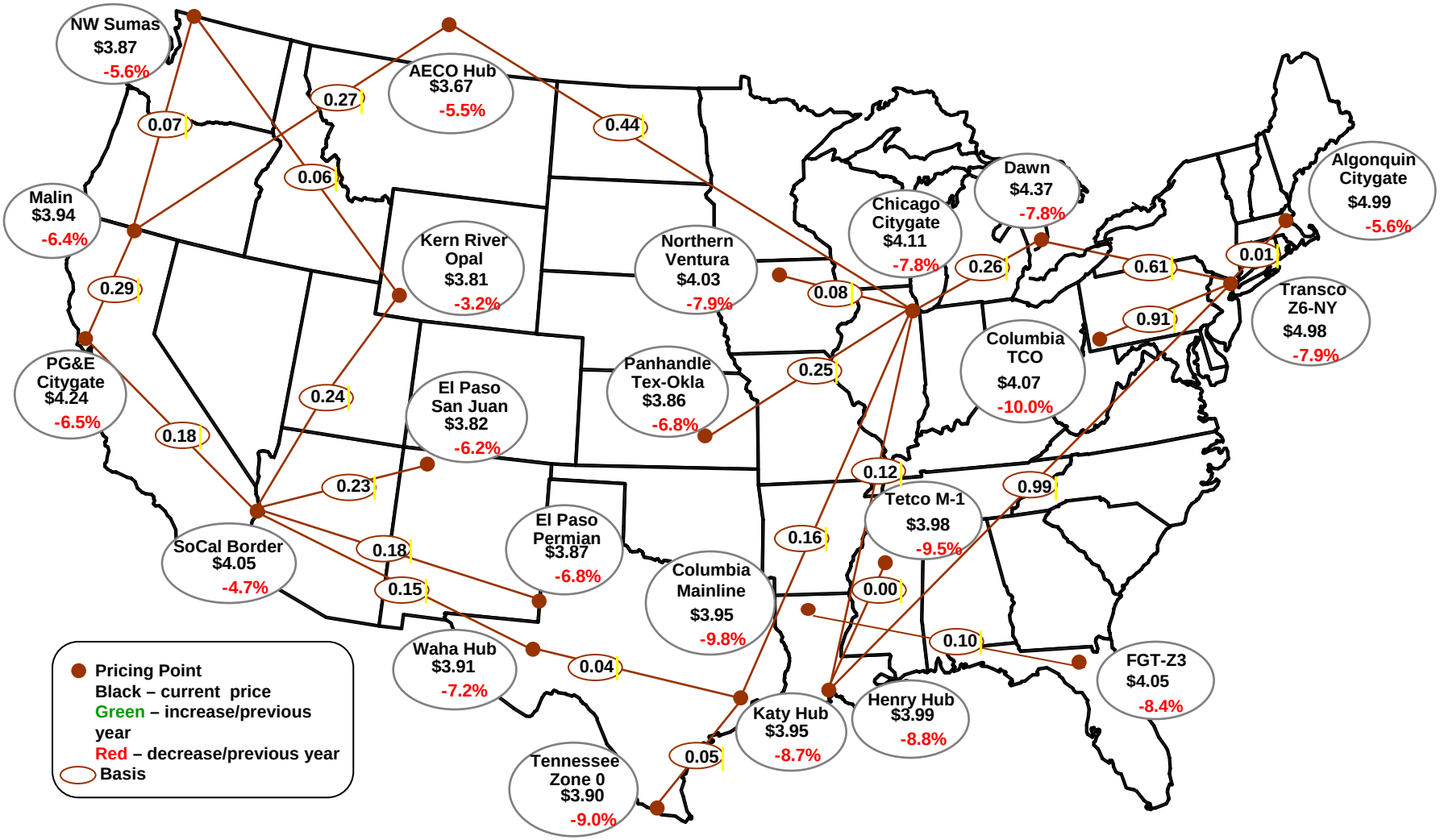
# Average Spot Gas Prices, 2011 ($MMBtu)




Source: Derived from *Platts* data.

Updated: March 13, 2012

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# World LNG Estimated December 2012 Landed Prices


Source: *Waterborne Energy, Inc*. Data in $US/MMBtu

Updated: November 8, 2012

OMS

Organization of MISO States

# Integrated Natural Gas Value Chain and Developing Tariffs

William H. Smith Jr.

Organization of MISO States

November 28-30, 2012

# Natural Gas Value Chain: Wellhead / Production

- Market characteristics
- Role of price information
- Production conditions
- Producer risks
- Goals of regulation
- Regulatory tools

# Natural Gas Value Chain: Gas Processing

- Current processing facilities
- Extracted products
- Costs and values of processing and products
- Regulatory objectives and methods
- Competitive potential

# Natural Gas Value Chain: Pipelines

- Current pipeline facilities
- Geographic markets
- Pipeline services
- Development of new facilities
- Service to new markets
- Pricing pipeline service
- Regulatory objectives

# Natural Gas Value Chain: Distribution

- Market and corporate structures
- Customer types and usage patterns
- Distribution cost characteristics
- Pricing distribution service
- Regulatory objectives

# Natural Gas Value Chain: Electric Generation

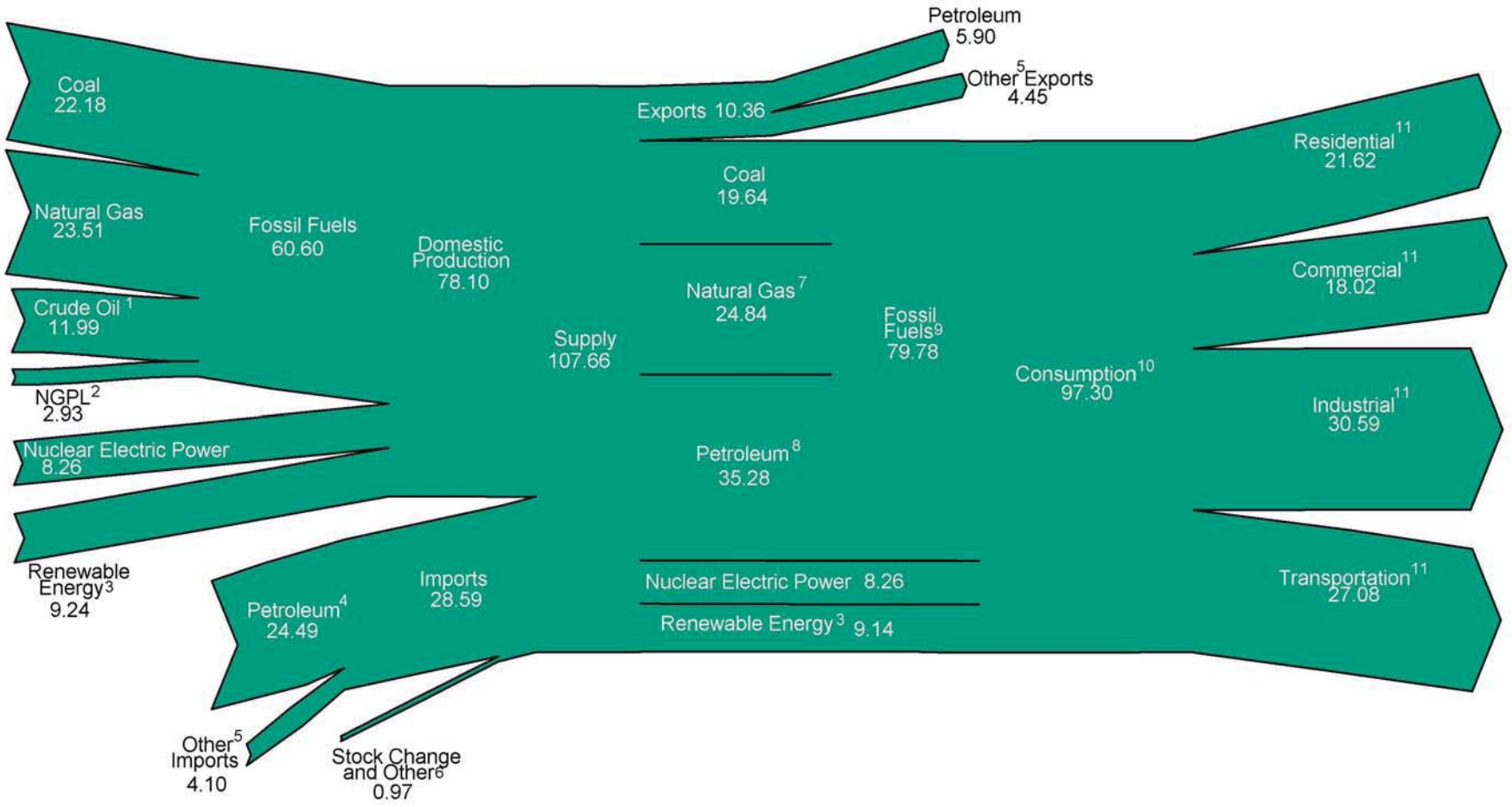
- Alternatives for Electric Generation
- Consequences of fuel choices
- Criteria for locating electric generation
- Gas pipeline service for generation
- Coordination of retail gas service and electric service

Purposes of regulation

- Investment
- Profit Control
- Rate Control
- Universal Service
- Rate Fairness
- Quality of Service
- Reliability
- Safety
- Use of Public Land
- Taking of Private Land
- Complaints
- Energy Efficiency
- Economic Development

## Figure 1.0 Energy Flow, 2011

(Quadrillion Btu)



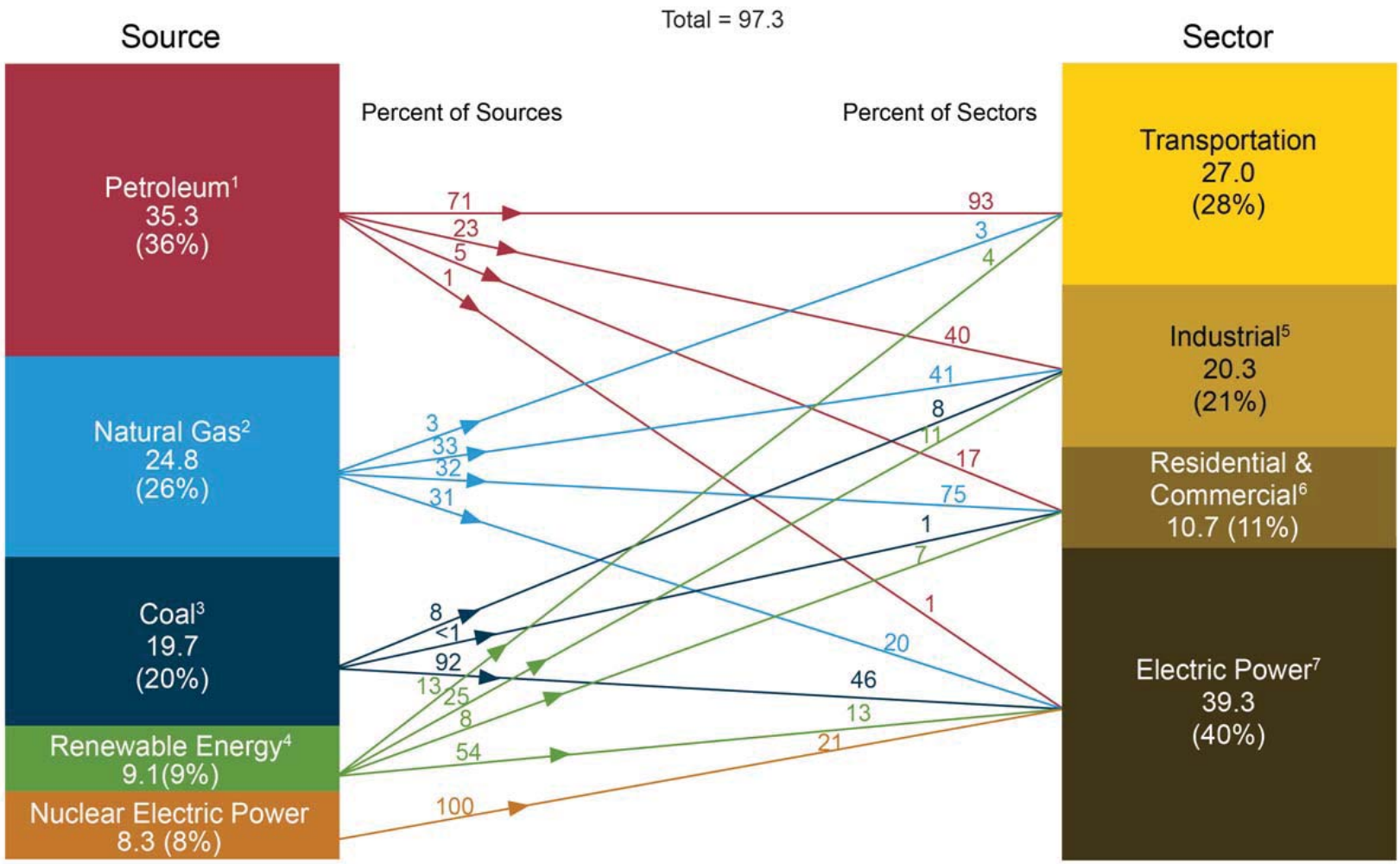

[1] Includes lease condensate.
[2] Natural gas plant liquids.
[3] Conventional hydroelectric power, biomass, geothermal, solar/photovoltaic, and wind.
[4] Crude oil and petroleum products. Includes imports into the Strategic Petroleum Reserve.
[5] Natural gas, coal, coal coke, biofuels, and electricity.
[6] Adjustments, losses, and unaccounted for.
[7] Natural gas only; excludes supplemental gaseous fuels.
[8] Petroleum products, including natural gas plant liquids, and crude oil burned as fuel.
[9] Includes 0.01 quadrillion Btu of coal coke net imports.
[10] Includes 0.13 quadrillion Btu of electricity net imports.
[11] Total energy consumption, which is the sum of primary energy consumption, electricity retail sales, and electrical system energy losses. Losses are allocated to the end-use sectors in proportion to each sector's share of total electricity retail sales. See Note, "Electrical Systems Energy Losses," at end of Section 2.

Notes: • Data are preliminary. • Values are derived from source data prior to rounding for publication. • Totals may not equal sum of components due to independent rounding.

Sources: Tables 1.1, 1.2, 1.3, 1.4, and 2.1a.

## Figure 2.0 Primary Energy Consumption by Source and Sector, 2011

(Quadrillion Btu)




[1] Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."

[2] Excludes supplemental gaseous fuels.

[3] Includes less than 0.1 quadrillion Btu of coal coke net imports.

[4] Conventional hydroelectric power, geothermal, solar/photovoltaic, wind, and biomass.

[5] Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.

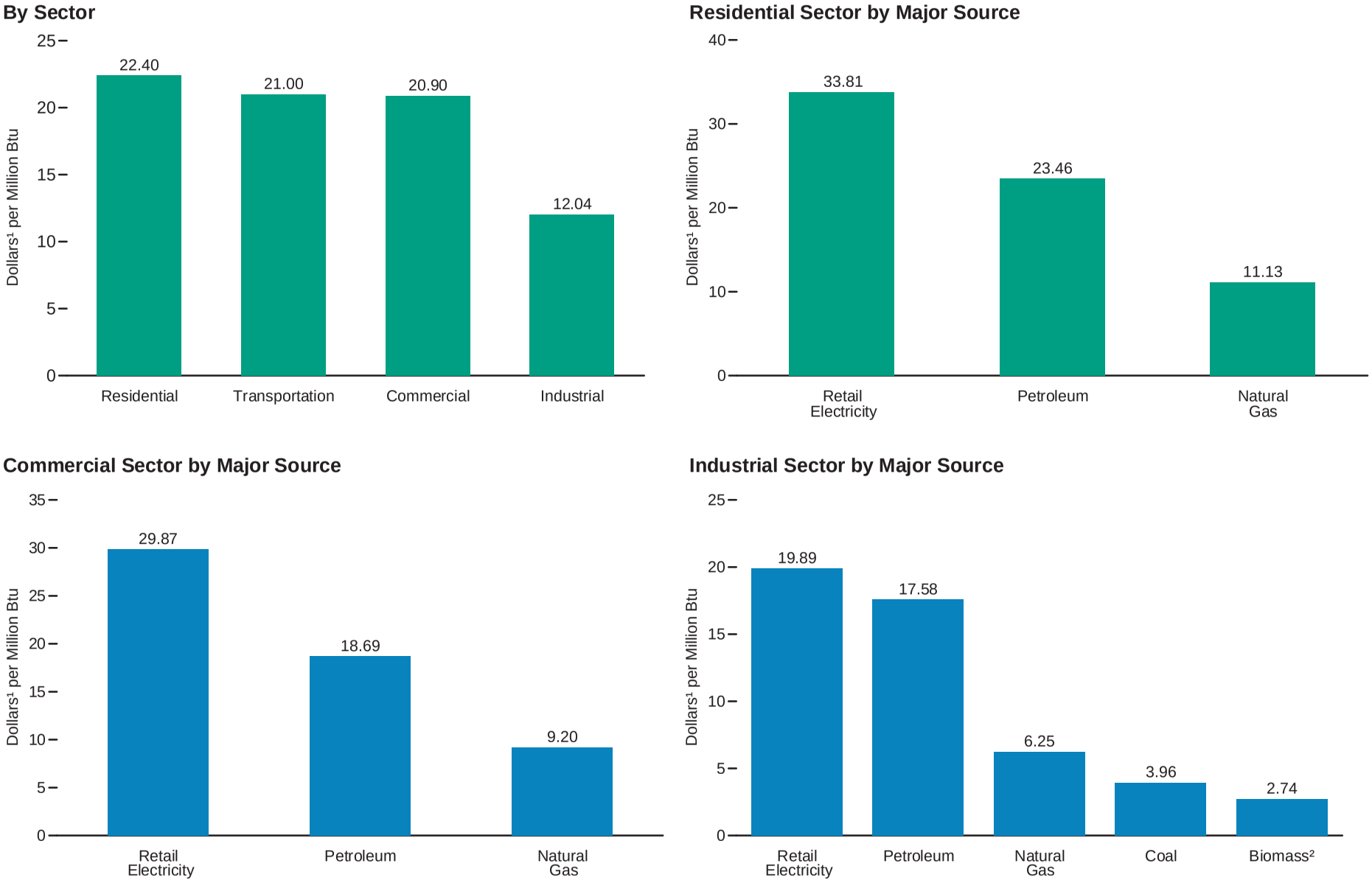
[6] Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.

[7] Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.1 quadrillion Btu of electricity net imports not shown under "Source."

Notes: Primary energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). • Sum of components may not equal total due to independent rounding.

Sources: U.S. Energy Information Administration, *Annual Energy Review 2011*, Tables 1.3, 2.1b-2.1f , 10.3, and 10.4.

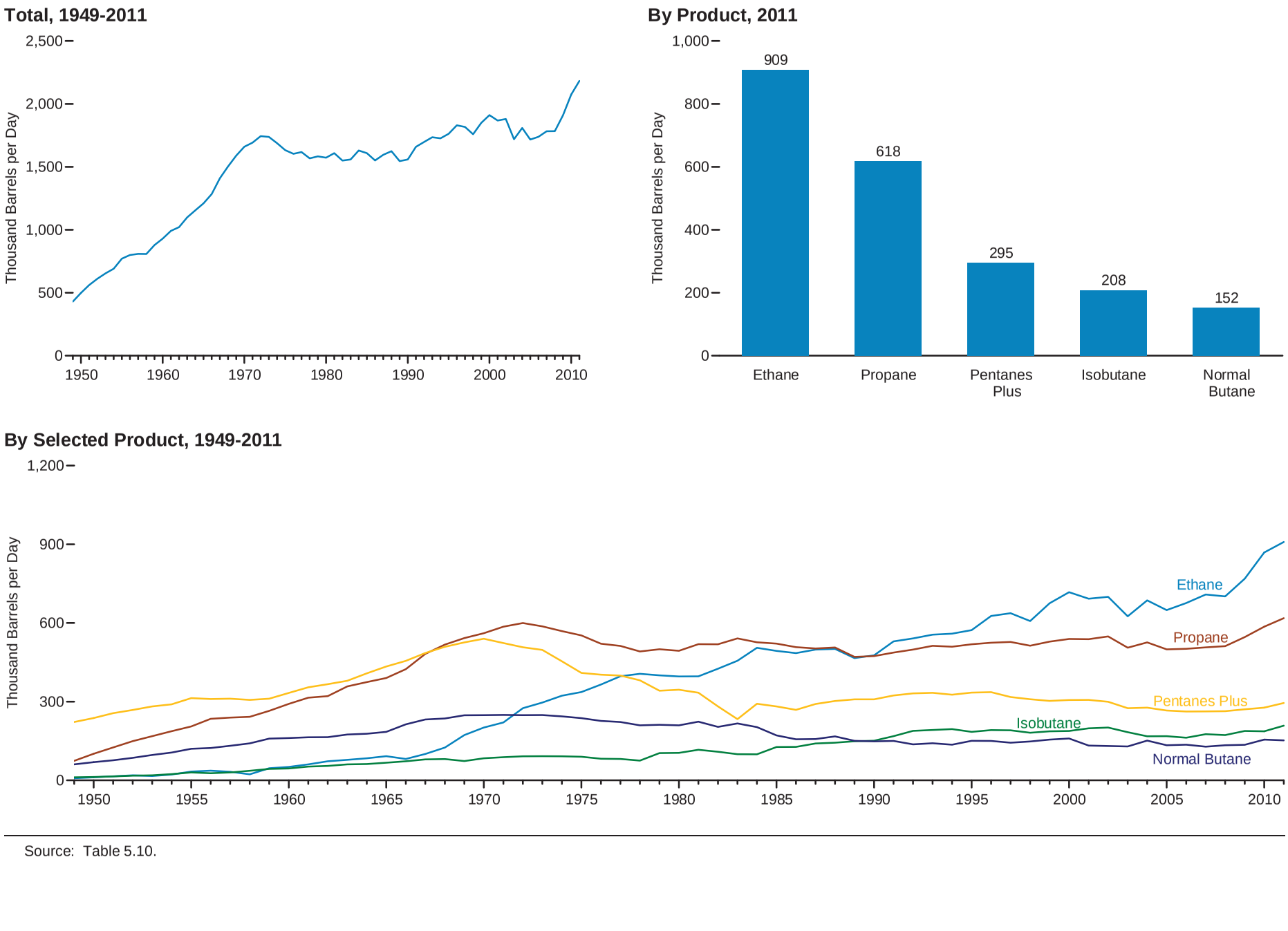
# Figure 3.4 Consumer Price Estimates for Energy by End-Use Sector, 2010




[1] Prices are not adjusted for inflation. See "Nominal Dollars" in Glossary.
[2] Wood and wood-derived fuels, and biomass waste; excludes fuel ethanol and biodiesel.

Notes: • Consumer prices are intended to represent prices paid by consumers. As such they include taxes where data are available. • There are no direct fuel costs for hydroelectric, geothermal, wind, or solar energy.
Source: Table 3.4.

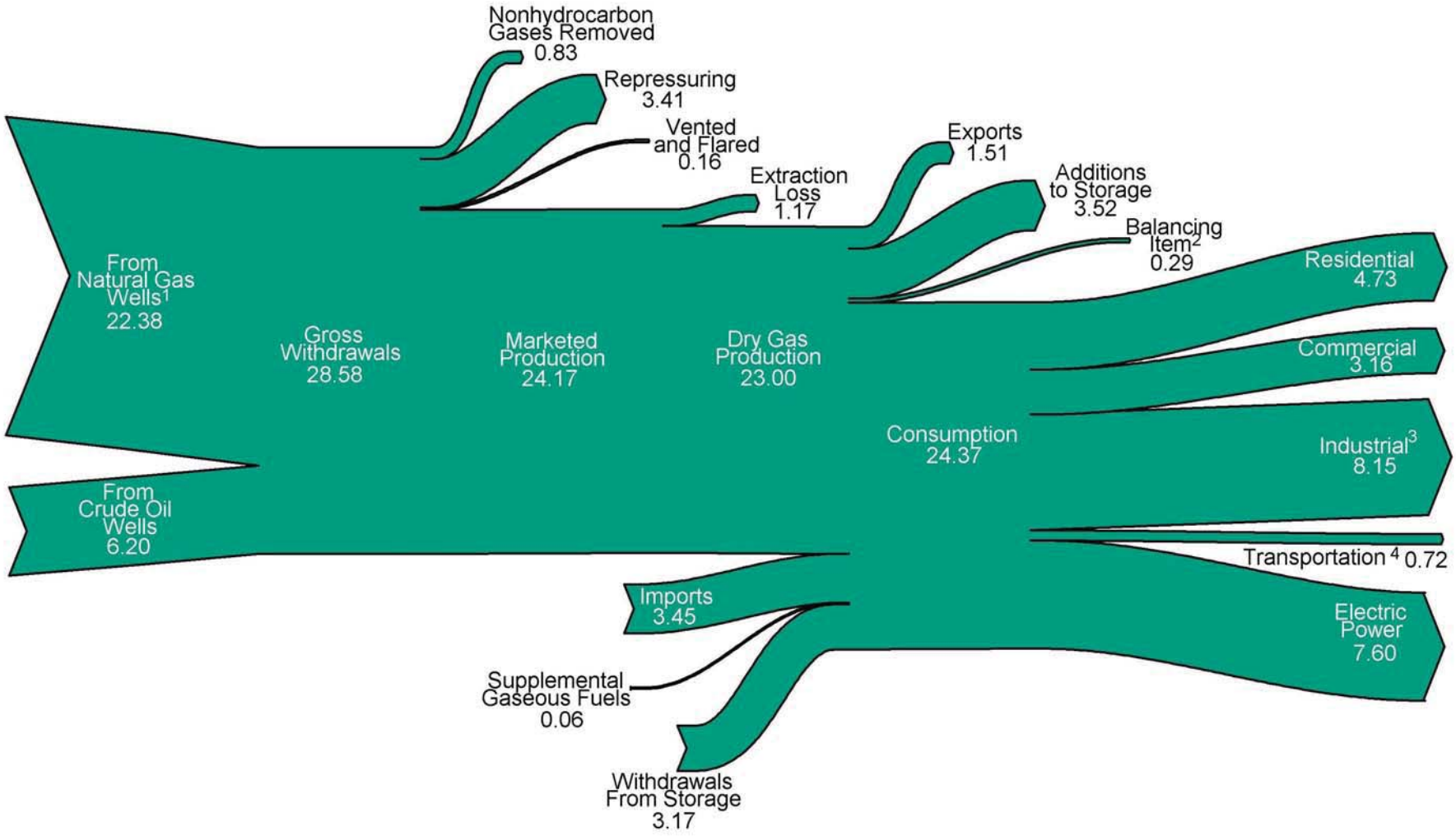
# Figure 5.10 Natural Gas Plant Liquids Production




Source: Table 5.10.

## Figure 6.0 Natural Gas Flow, 2011

(Trillion Cubic Feet)




[1] Includes natural gas gross withdrawals from coalbed wells and shale gas wells.

[2] Quantities lost and imbalances in data due to differences among data sources.

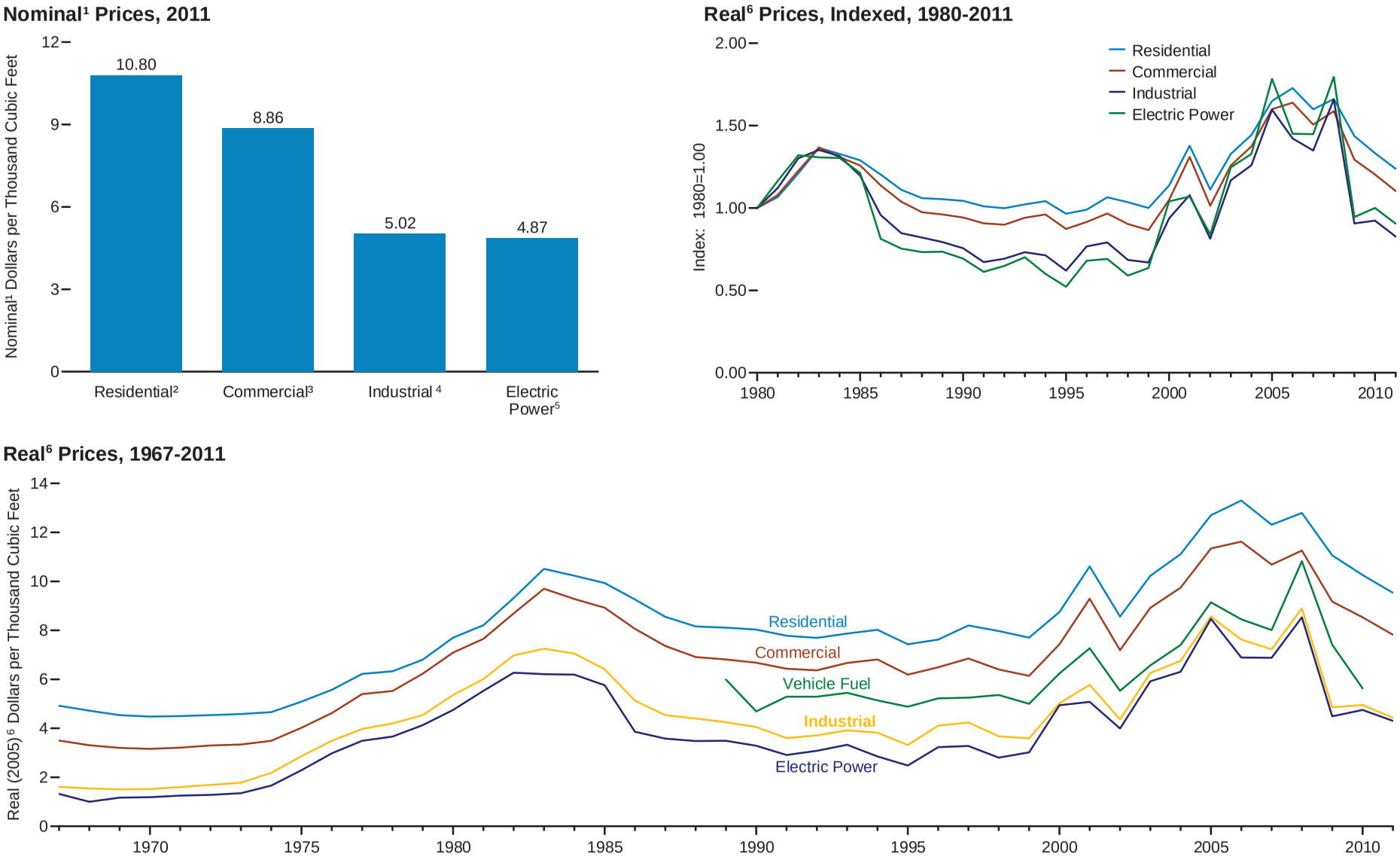
[3] Lease and plant fuel, and other industrial.

[4] Natural gas consumed in the operation of pipelines (primarily in compressors), and as fuel in the delivery of natural gas to consumers; plus a small quantity used as vehicle fuel.

Notes: • Data are preliminary. • Values are derived from source data prior to rounding for publication. • Totals may not equal sum of components due to independent rounding.

Sources: Tables 6.1, 6.2, and 6.5.

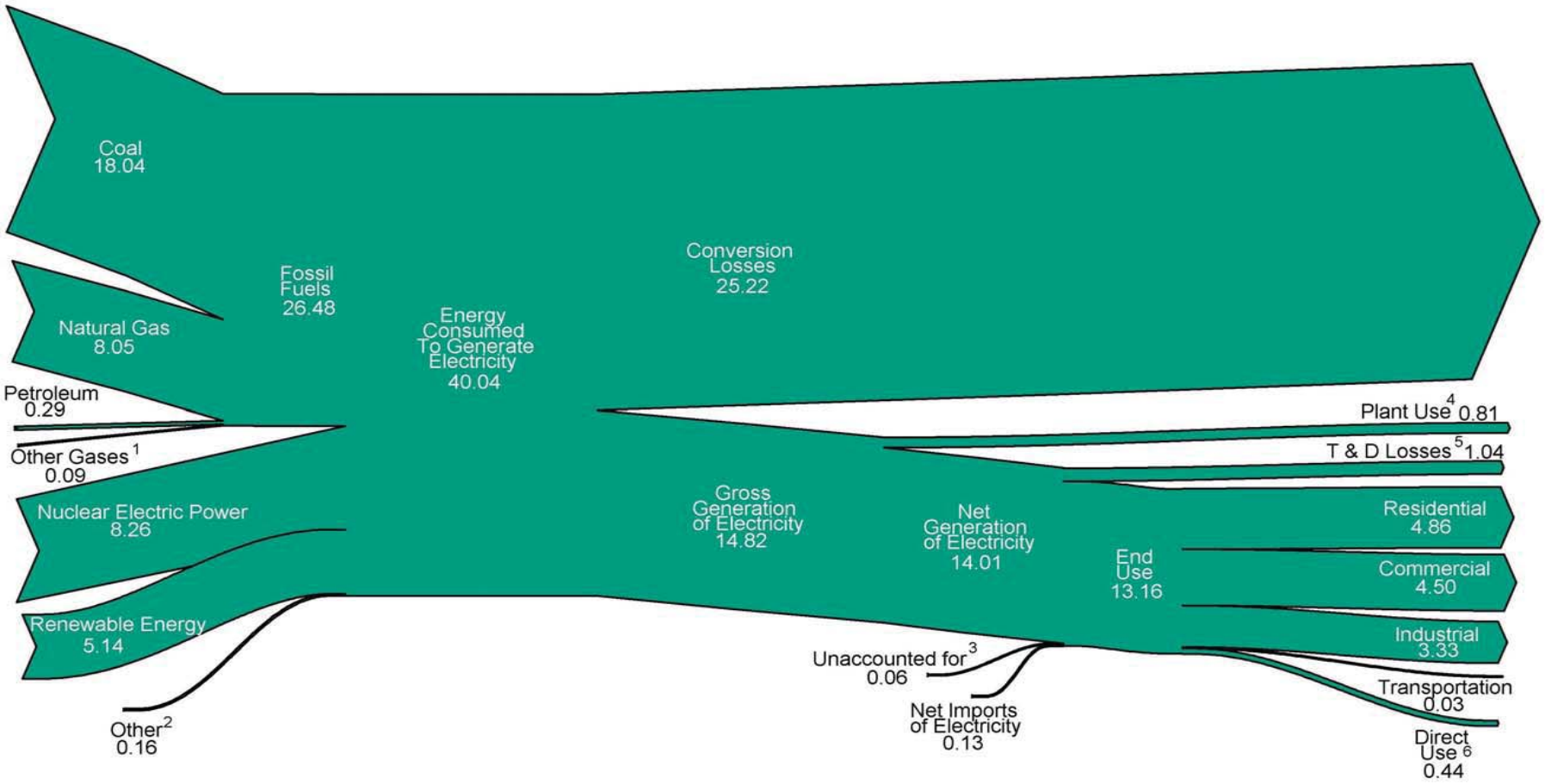
# Figure 6.8 Natural Gas Prices by Sector




[1] See "Nominal Dollars" in Glossary.
[2] Based on 95.7 percent of volume delivered.
[3] Based on 62.3 percent of volume delivered.
[4] Based on 16.0 percent of volume delivered.
[5] Based on 101.2 percent of volume delivered. For an explanation of values over 100 percent, see Table 6.8, footnote 8.
[6] In chained (2005) dollars, calculated by using gross domestic product implicit price deflators in Table D1. See "Chained Dollars" in Glossary.

Source: Table 6.8.

## Figure 8.0 Electricity Flow, 2011
(Quadrillion Btu)




[1] Blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.

[2] Batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, miscellaneous technologies, and non-renewable waste (municipal solid waste from non-biogenic sources, and tire-derived fuels).

[3] Data collection frame differences and nonsampling error. Derived for the diagram by subtracting the "T & D Losses" estimate from "T & D Losses and Unaccounted for" derived from Table 8.1.

[4] Electric energy used in the operation of power plants.

[5] Transmission and distribution losses (electricity losses that occur between the point of generation and delivery to the customer) are estimated as 7 percent of gross generation.

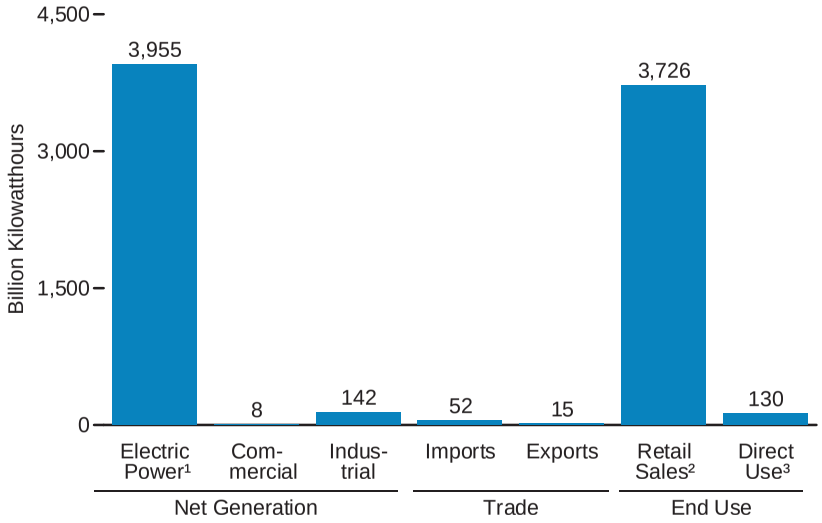
[6] Use of electricity that is 1) self-generated, 2) produced by either the same entity that consumes the power or an affiliate, and 3) used in direct support of a service or industrial process located within the same facility or group of facilities that house the generating equipment. Direct use is exclusive of station use.

Notes: • Data are preliminary. • See Note, "Electrical System Energy Losses," at the end of Section 2. • Net generation of electricity includes pumped storage facility production minus energy used for pumping. • Values are derived from source data prior to rounding for publication. • Totals may not equal sum of components due to independent rounding.

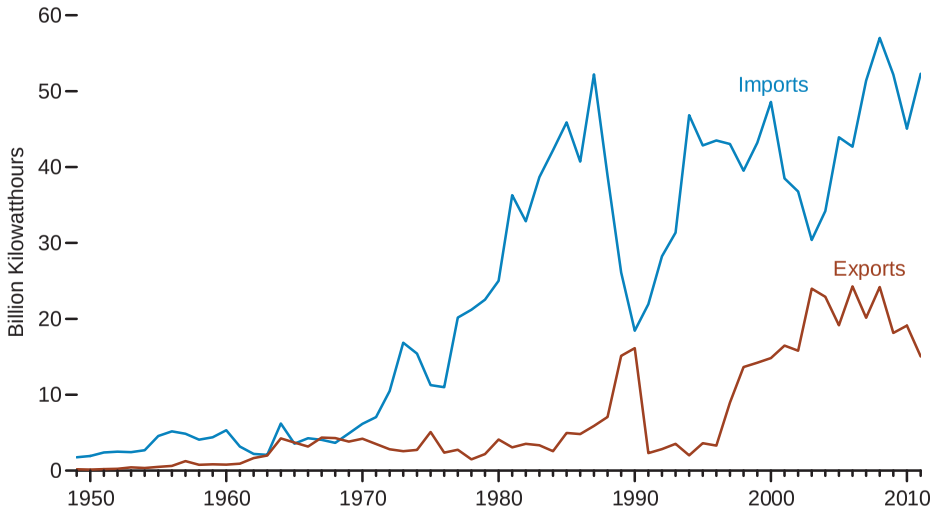
Sources: Tables 8.1, 8.4a, 8.9, A6 (column 7), and U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

# Figure 8.1 Electricity Overview

### Overview, 2011

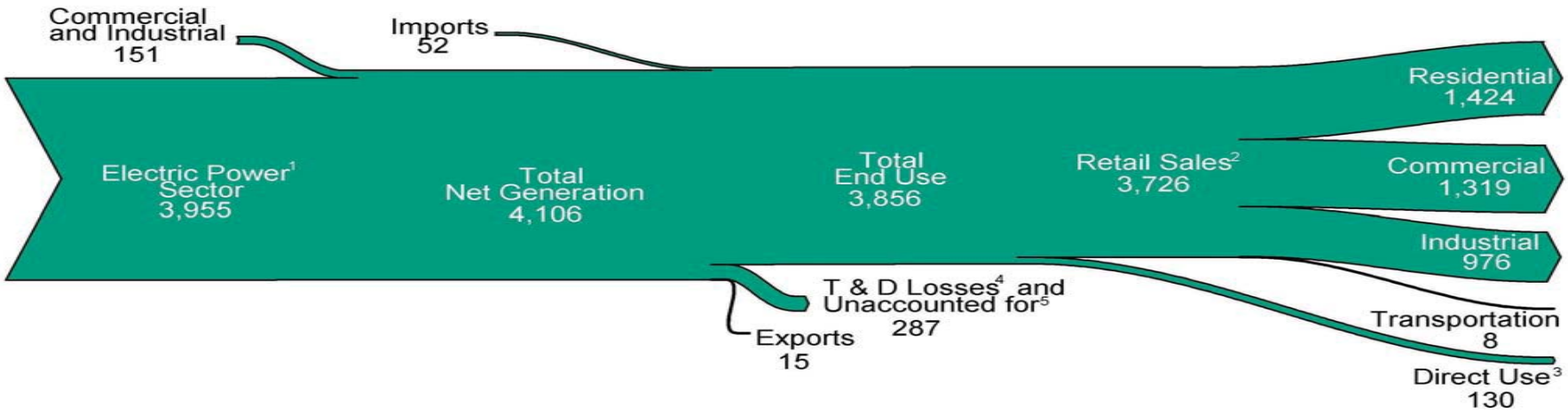



### Electricity Trade, 1949-2011




### Net-Generation-to-End-Use Flow, 2011

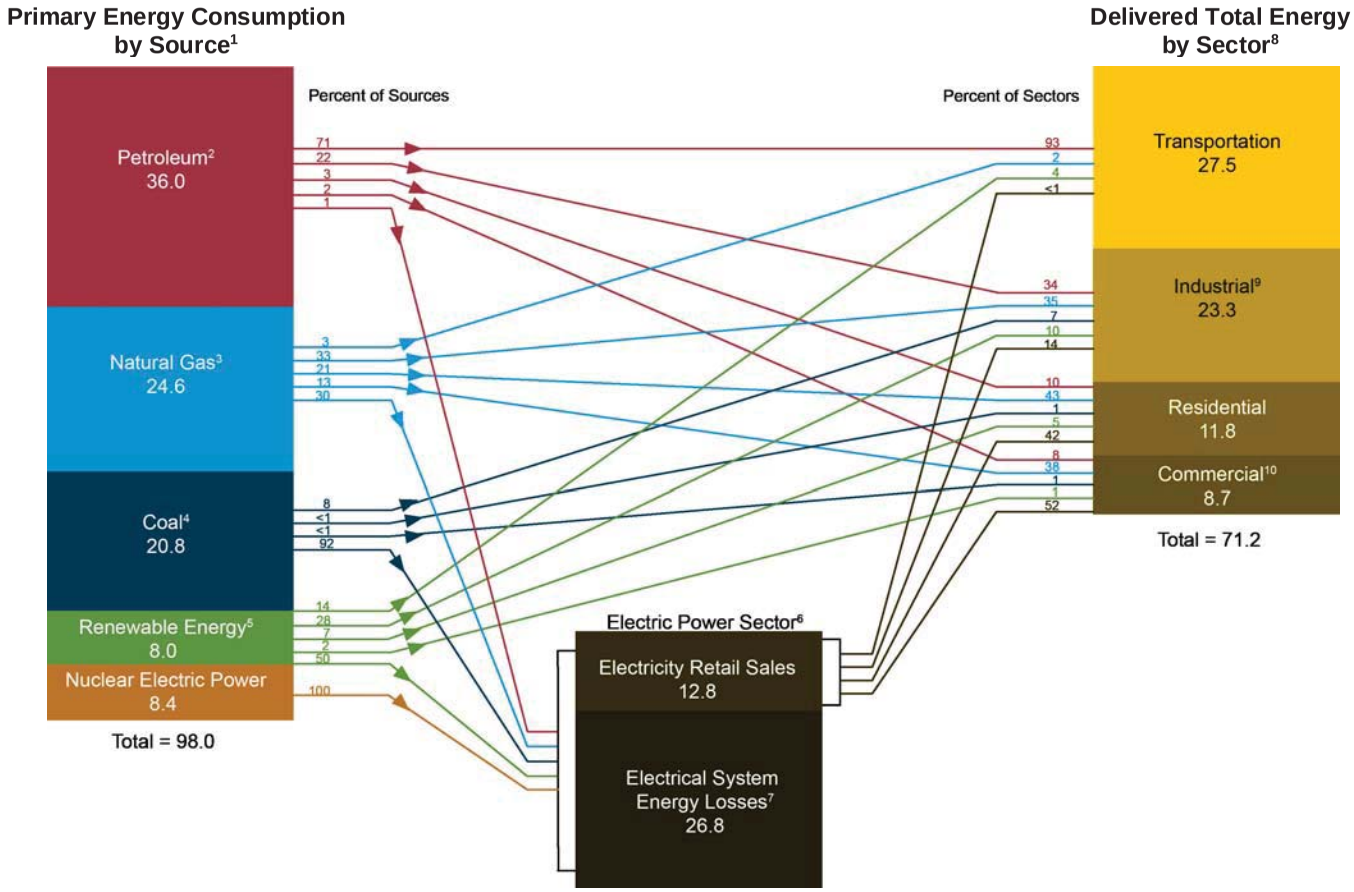
(Billion Kilowatthours)




[1] Electricity-only and combined-heat-and-power plants within the NAICS 22 category whose primary business is to sell electricity, or electricity and heat, to the public.
[2] Electricity retail sales to ultimate customers reported by electric utilities and other energy service providers.
[3] See Table 8.1, footnote 8.
[4] Transmission and distribution losses (electricity losses that occur between the point of generation and delivery to the customer). See Note, "Electrical System Energy Losses," at the end of Section 2.
[5] Data collection frame differences and nonsampling error.
Sources: Tables 8.1 and 8.9.

# Figure F1. Primary Energy Consumption and Delivered Total Energy, 2010

(Quadrillion Btu)




[1] Includes electricity net imports, not shown separately.

[2] Does not include biofuels that have been blended with petroleum–biofuels are included in "Renewable Energy."

[3] Excludes supplemental gaseous fuels.

[4] Includes less than 0.1 quadrillion Btu of coal coke net exports.

[5] Conventional hydroelectric power, geothermal, solar/PV, wind, and biomass.

[6] Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.

[7] Calculated as the primary energy consumed by the electric power sector minus the energy content of electricity retail sales. See Note, "Electrical System Energy Losses," at end of Section 2.

[8] Includes transformation losses other than electrical system energy losses. For example, see notes 9 and 10 on this page.

[9] Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.

[10] Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.

Note: Sum of components may not equal total due to independent rounding.

Sources: U.S. Energy Information Administration, *Annual Energy Review 2010*, Tables 1.3, 2.1b-f, 10.3, and 10.4.