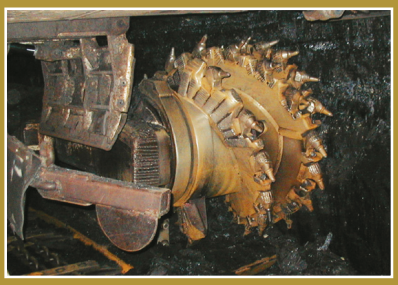
Utah's Energy Landscape

3rd Edition

by Michael D. Vanden Berg



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Utah's Energy Landscape

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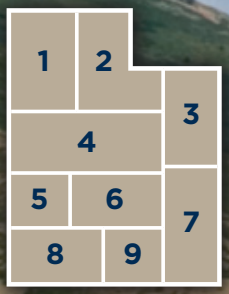
TABLE OF CONTENTS

Message from the Governor 1
Introduction 2
Highlights 3
Contacts 4
Overview 5
Energy Economics 9
Coal 12
Crude Oil and Petroleum Products 18
Natural Gas 25
Renewable Resources 31
Unconventional Petroleum Resources—Oil Shale and Oil Sands 37
Uranium 38
Electricity 40

COVER PHOTO CAPTIONS



1. *Milford wind farm (photo courtesy of First Wind)*
2. *Utah oil shale*
3. *Drill rig in Natural Buttes field*
4. *Solar farm at Natural Bridges National Monument*
5. *Longwall mining machine at the Deer Creek coal mine*
6. *Coal loadout at the SUFCO mine*
7. *Crude oil pump jack from the Aneth oil field*
8. *Huntington coal-fired power plant*
9. *Flaming Gorge dam*

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Background photo: Spanish Fork wind farm

State of Utah

Gary R. Herbert
Governor

Office of the Governor
Salt Lake City, Utah
84114-2220

Spencer J. Cox
Lieutenant Governor

Dear Reader,

Energy is one of Utah's four cornerstones for success, and the development of clean, secure, low-cost energy is one of my top priorities as governor. I am pleased to introduce *Utah's Energy Landscape*, a publication to educate Utah residents and others about our state's vast and diverse energy portfolio.

Energy affects our lives and communities profoundly. This booklet provides an excellent overview of where the current and potential energy resources exist throughout our state, and how energy production influences our job market, corporate profitability, energy costs, and consumer behavior. It also shows that it is possible to pursue expanded energy resource development while maintaining the pristine character of our precious and unique outdoor recreation areas.

I commend the Utah Geological Survey and Utah Office of Energy Development for their leadership and commitment to help support and strengthen one of Utah's leading industries, and for educating the public about energy development in Utah. I encourage you to contact these agencies for further information about energy exploration and development in our great state. Utah's energy industry is ready to grow and prosper now and far into the future!

Sincerely,

Gary R. Herbert
Governor

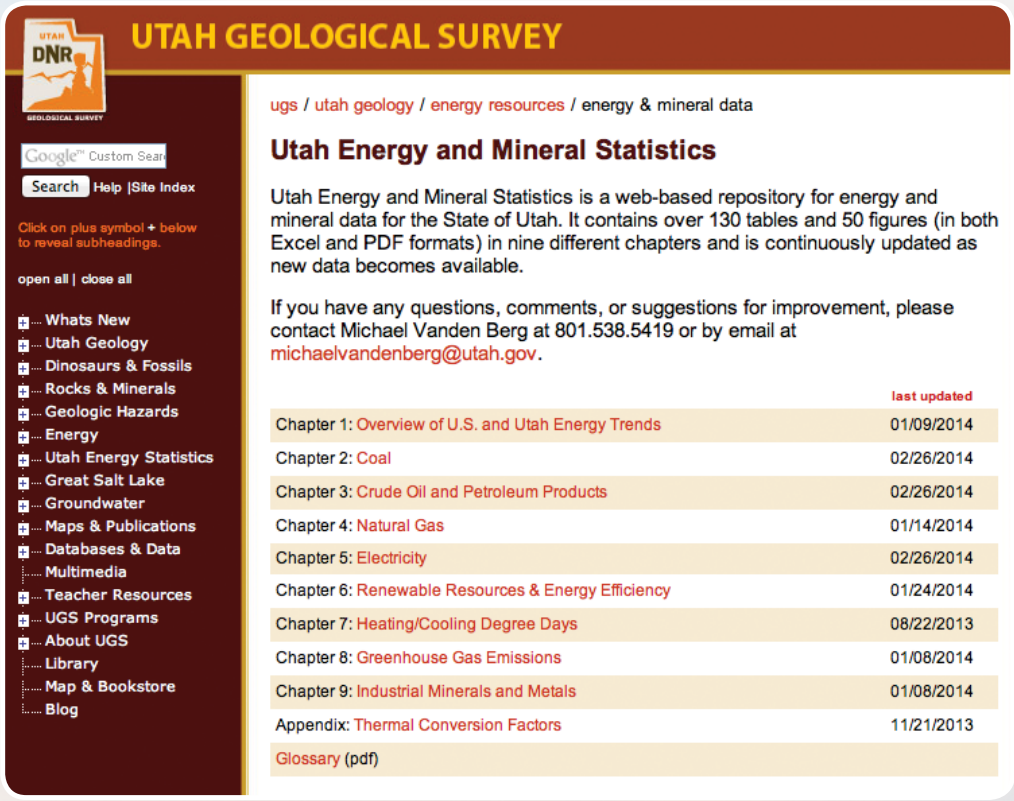
INTRODUCTION

Utah is fortunate to have abundant and diverse energy resources including large reserves of conventional fossil fuels, several areas suitable for renewable resource development, and vast quantities of untapped unconventional oil shale and oil sand resources. This publication, *Utah's Energy Landscape*, now in its third edition, was created to offer a complete, visual-based description of Utah's diverse energy portfolio.

The graphs within this document were created using data compiled by the Utah Geological Survey (UGS) from several sources, including the U.S. Department of Energy's Energy Information Administration (EIA), the Utah Division of Oil, Gas, and Mining (DOGM), and the Utah State Tax Commission, as well as in-house surveys and conversations with individuals and companies.

Utah Energy and Mineral Statistics (UEMS) is a web-based data repository located on the UGS website (see screen shot below) and contains all the energy data used to create the graphs contained in this report. Each graph includes a reference table number, indicating where the data can be found and downloaded either as a Microsoft Excel® file or an Adobe® PDF file.

Utah Energy and Mineral Statistics website: http://geology.utah.gov/emp/energydata



UTAH GEOLOGICAL SURVEY

Search | Help | Site Index

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open all | close all

- Whats New
- Utah Geology
- Dinosaurs & Fossils
- Rocks & Minerals
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- Energy
- Utah Energy Statistics
- Great Salt Lake
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- Maps & Publications
- Databases & Data
  - Multimedia
- Teacher Resources
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Utah Energy and Mineral Statistics

Utah Energy and Mineral Statistics is a web-based repository for energy and mineral data for the State of Utah. It contains over 130 tables and 50 figures (in both Excel and PDF formats) in nine different chapters and is continuously updated as new data becomes available.

If you have any questions, comments, or suggestions for improvement, please contact Michael Vanden Berg at 801.538.5419 or by email at michaelvandenberg@utah.gov.

	last updated
Chapter 1: Overview of U.S. and Utah Energy Trends	01/09/2014
Chapter 2: Coal	02/26/2014
Chapter 3: Crude Oil and Petroleum Products	02/26/2014
Chapter 4: Natural Gas	01/14/2014
Chapter 5: Electricity	02/26/2014
Chapter 6: Renewable Resources & Energy Efficiency	01/24/2014
Chapter 7: Heating/Cooling Degree Days	08/22/2013
Chapter 8: Greenhouse Gas Emissions	01/08/2014
Chapter 9: Industrial Minerals and Metals	01/08/2014
Appendix: Thermal Conversion Factors	11/21/2013
Glossary (pdf)	

Background photo: Book Cliffs outside Price, UT

UTAH ENERGY HIGHLIGHTS

- **Overview:** The majority of energy (in Btu) produced annually in Utah is from natural gas, which surpassed coal for the first time in Utah's history in 2010 (page 6).
- **Economics:** The value of Utah's energy-related production reached nearly $5 billion in 2012 (page 9).
- **Economics:** Wages for energy-related jobs are nearly double the average annual wage for all employment in Utah (page 11).
- **Coal:** Despite recent lower coal production totals, higher coal prices helped push the total value of annual Utah coal production to over $600 million (page 17).
- **Crude oil and natural gas:** The number of oil and gas well completions in Utah averaged 904 per year over the past 9 years, a major increase over the 274 wells per year averaged throughout the 1990s (page 19).
- **Crude oil:** Utah refineries received record amounts of crude oil in 2012, with increased amounts coming from in-state (44%) and decreased amounts coming from Canada (7%) (page 22).
- **Crude oil:** The value of crude oil produced in Utah reached an all-time inflation-adjusted high of $2.5 billion in 2012 (page 24).
- **Natural gas:** Natural gas production in Utah reached a record high in 2012 of 491 billion cubic feet (page 27).
- **Natural gas:** Utah's average price of residential natural gas in 2012 was $8.70 per thousand cubic feet, the 12th lowest in the nation (page 30).
- **Renewables:** Utah is one of only six states to produce electricity from geothermal sources (page 33).
- **Electricity:** In 2012, 78% of the electricity generated in Utah was from coal-burning power plants. Electricity generation from natural-gas power plants more than doubled between since 2007, increasing its total share in 2012 to 17% (page 41).
- **Electricity:** Sales (consumption) of electricity in Utah increase an average of 4.3% each year (page 43).
- **Electricity:** Utah's average price of residential electricity in 2012 was 9.9 cents per kWh, the 11th lowest in the nation and 20% lower than the national average (page 45).

UTAH ENERGY CONTACTS

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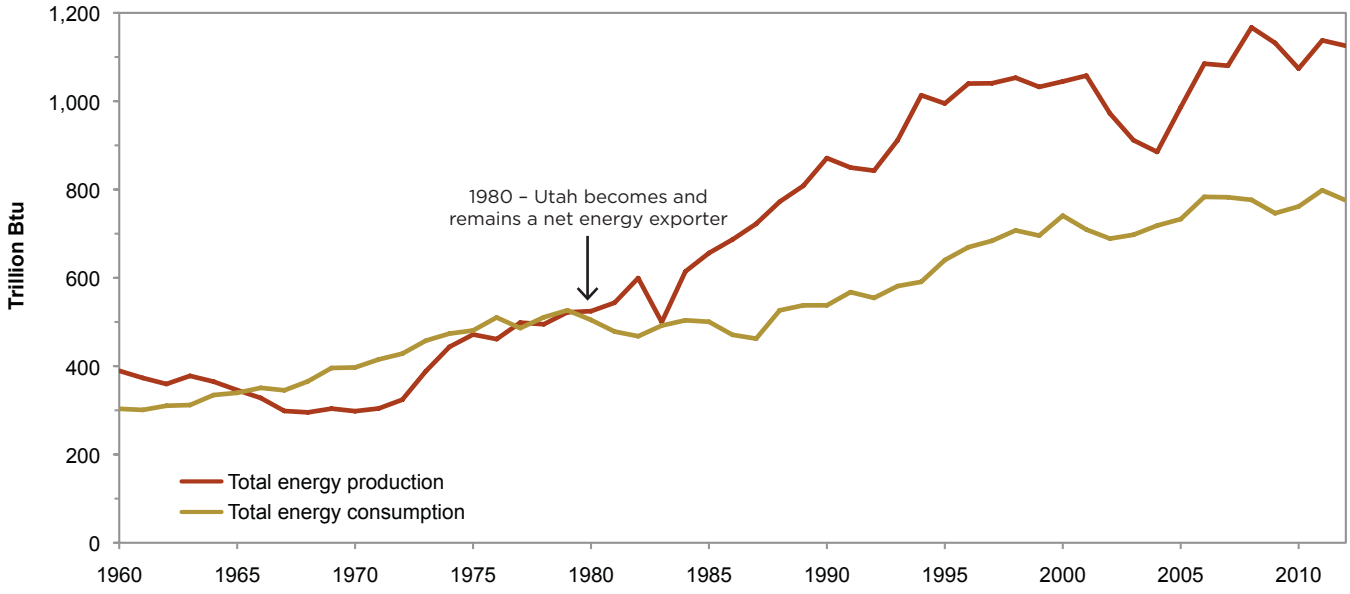
governor.utah.gov/publiclands

Background photo: Drilling rig at the Covenant Field, central Utah

overview

Utah Energy Balance

Production and Consumption, 1960–2012

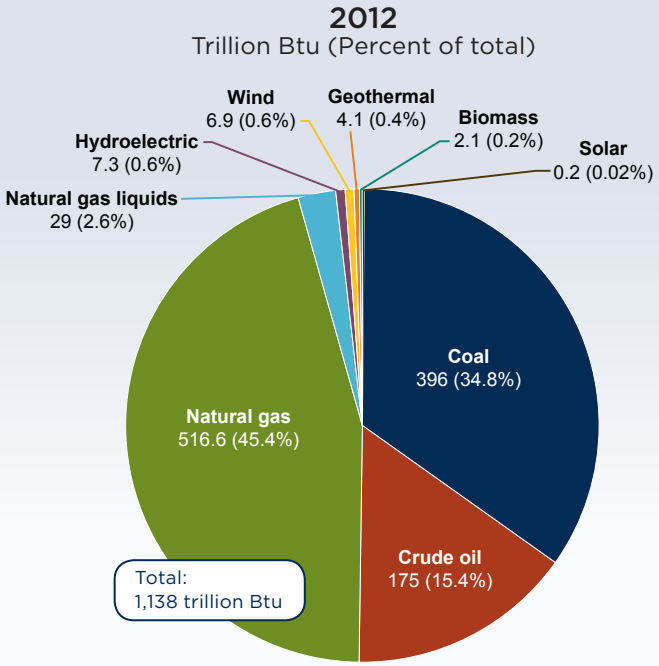


UEMS website table: Table 1.4 | Source: EIA, UGS
Note: Consumption data for 2012 are estimated.

Utah produced 31% more energy than it consumed in 2012, continuing its status as a net-energy exporter. The majority of this excess energy was in the form of exported coal and natural gas. Utah also exports significant amounts of electricity, produced from both fossil fuels and renewable sources.

DNR solar array

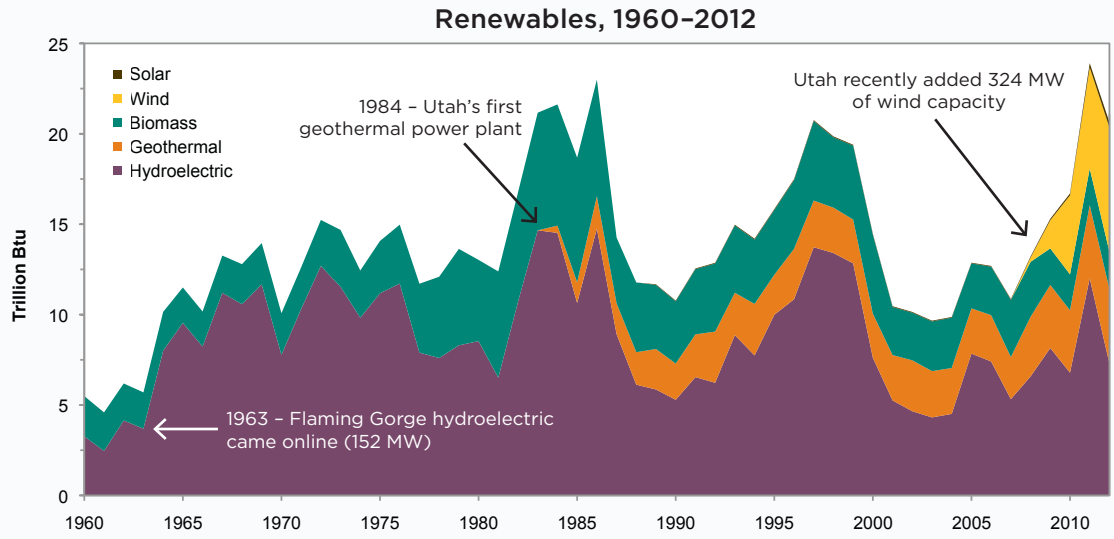
Energy Production in Utah by Source

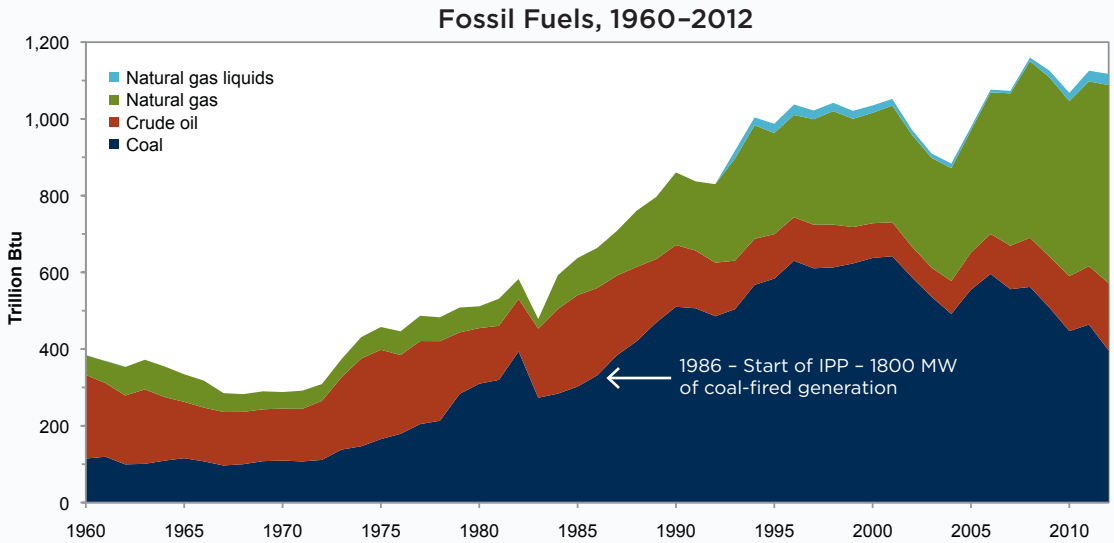


Fossil fuels made up 98.2% of Utah's total energy production in 2012, while renewable sources accounted for only 1.8% of Utah's production portfolio. Coal has historically dominated Utah's energy production (in terms of Btu), but starting in 2010, natural gas has become the dominate annual energy production source.

UEMS website table: Table 1.8 | Source: EIA, UGS

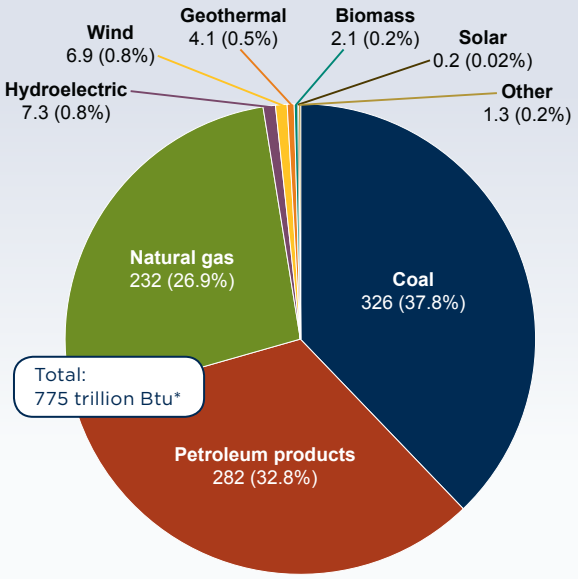
Note: Natural gas liquids included with natural gas prior to 1993, IPP = Intermountain Power Plant.



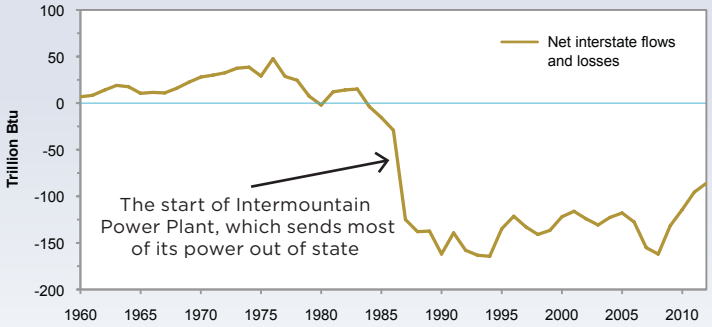


Energy Consumption in Utah by Source

2012
Trillion Btu (Percent of total)



Net Interstate Electricity
Flows and Losses in Utah, 1960–2012

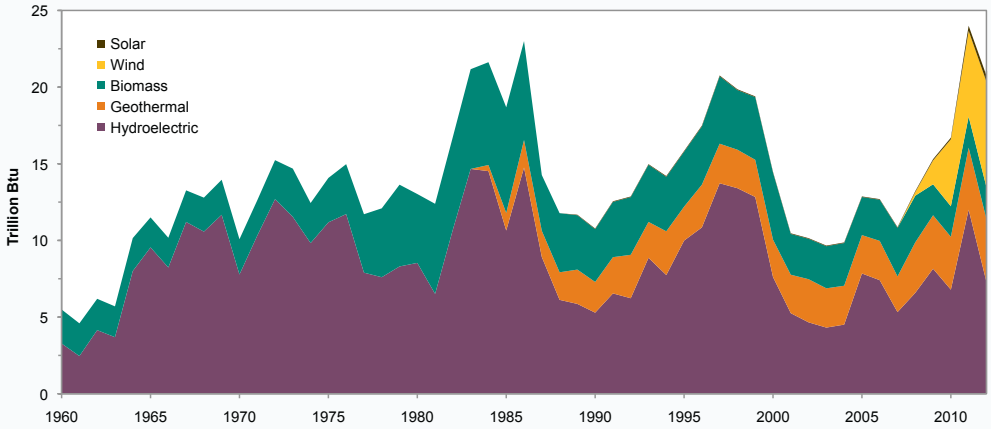


UEMS website table: Table 1.14 | Source: EIA, UGS

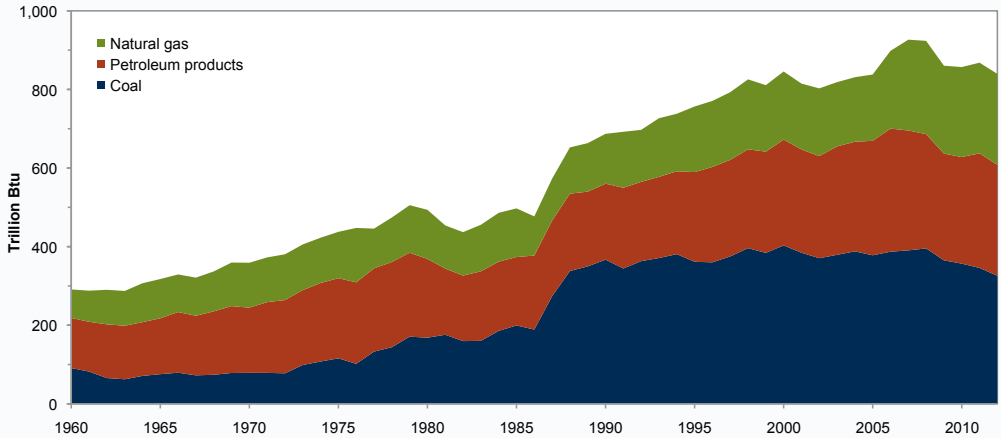
Note: EIA assumes that all renewable electric generation originating in Utah is also consumed in Utah, but this is not always the case (e.g., electricity from the Milford wind farm is sold to California); 2012 data are estimated.

*Total includes net interstate flows and losses. Net interstate flow of electricity is the difference between the amount of energy in the electricity sold within a state (including associated losses) and the energy input at the electric utilities within the state. A positive number indicates that more electricity (including associated losses) came into the state than went out of the state during the year; conversely, a negative number indicates that more electricity (including associated losses) went out of the state than came into the state.

Renewables, 1960–2012



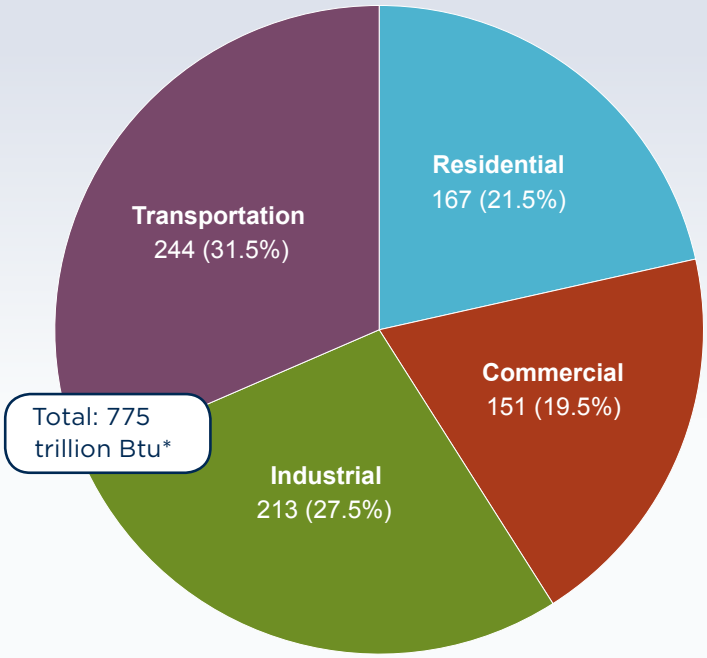
Fossil Fuels, 1960–2012



Fossil fuels made up 97.6% of Utah's total energy consumption in 2012, while renewable sources only accounted for 2.4% of Utah's consumption portfolio. These graphs do not include net interstate flows and losses (see inset graph); Utah exported 86 trillion Btu of electricity (including losses) in 2012, thus reducing total consumption to 775 trillion Btu.

Energy Consumption in Utah by Sector

2012
Trillion Btu (Percent of total)

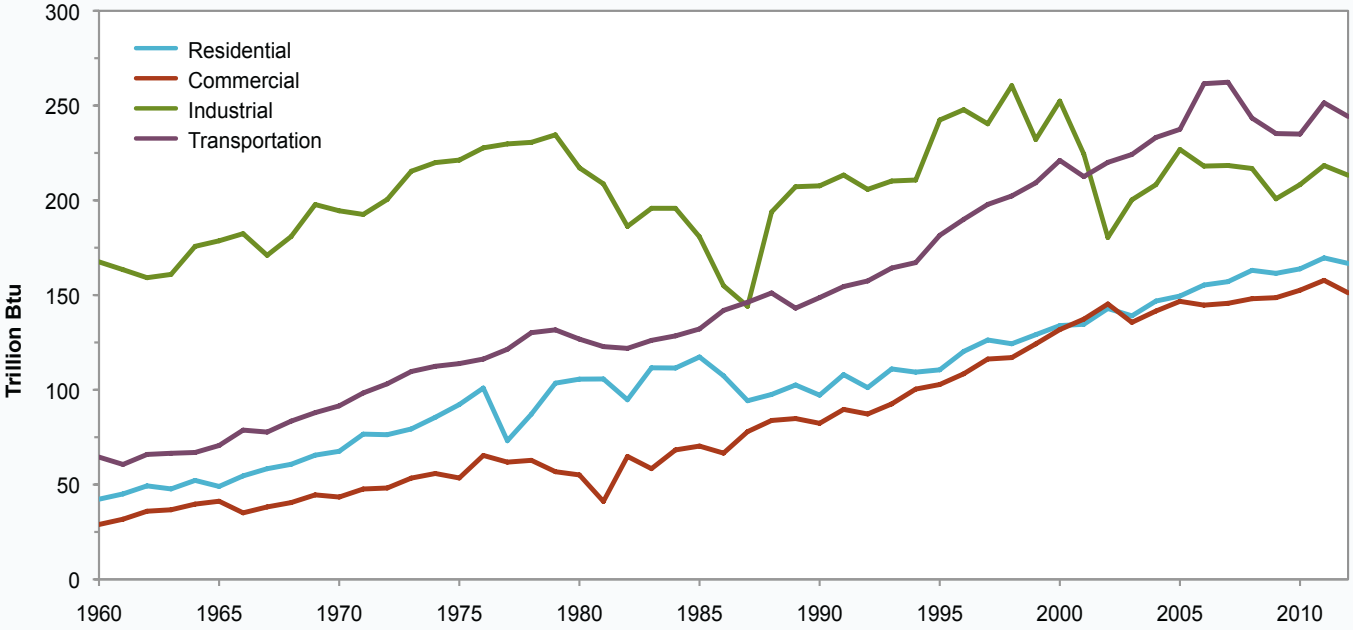


*Includes net interstate flows and losses

UEMS website table: Table 1.16 | Source: EIA
Note: 2012 data are estimated.

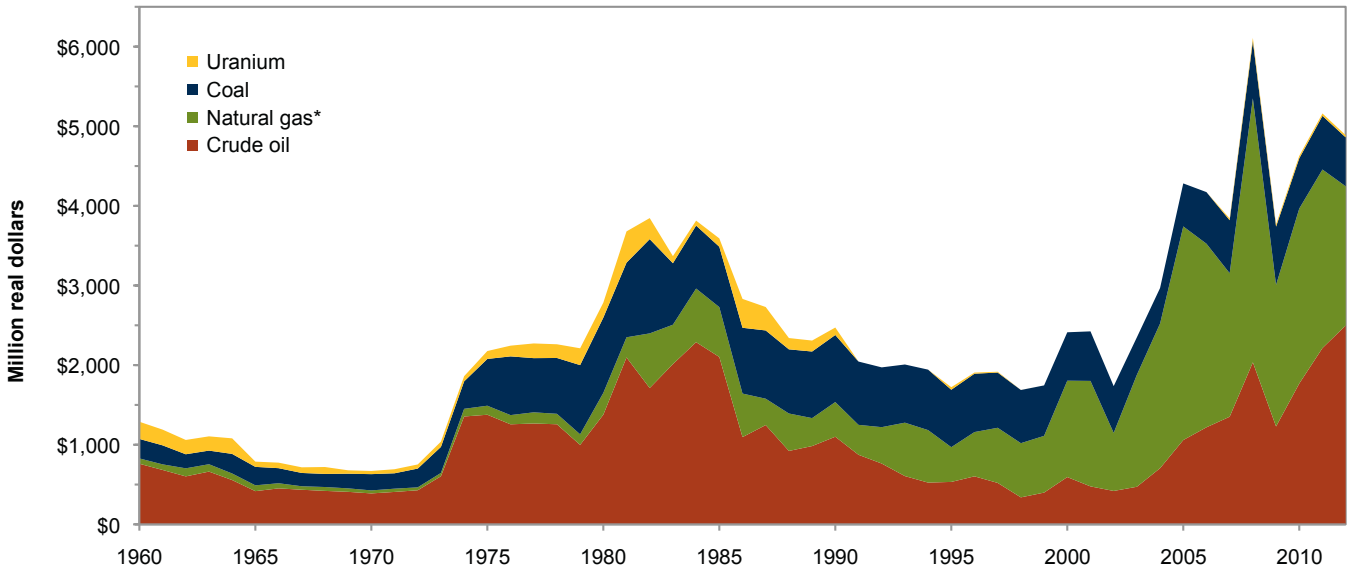
The transportation sector, mostly gasoline and diesel for vehicles, was the largest consumer of energy in Utah in 2012 (31.5%). The residential, commercial, and transportation sectors have all gradually increased over time, consistent with increasing population and increasing energy consumption per capita, while the industrial sector follows a pattern more closely tied to the national economy (e.g., economy-related dips in the mid-1980s and early 2000s).

1960–2012



energy economics

Value of Energy Production in Utah, 1960–2012



*Includes natural gas liquids

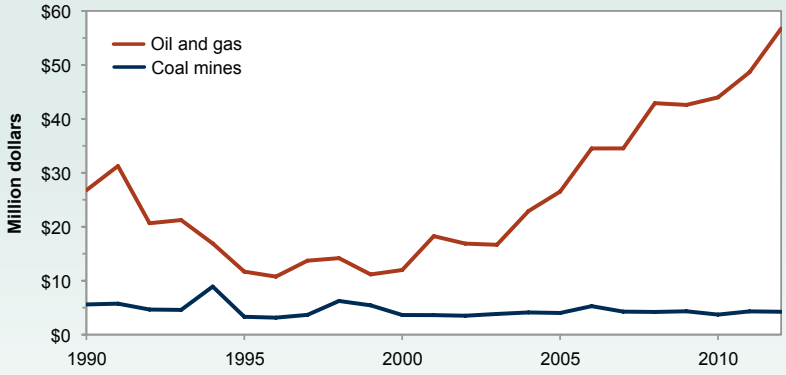
Source: UGS

Note: Real = inflation-adjusted dollars calculated using the Consumer Price Index from the U.S. Bureau of Labor Statistics.

The value of energy-related production (electric generation from renewable sources is not included) in Utah totaled $4.9 billion in 2012. Energy production values have been high since 2004 (even after adjusting for inflation) when crude oil and natural gas prices surged to levels not seen since the mid-1980s.

Drill rig in the Aneth oil field

Property Taxes Charged Against Petroleum & Coal Extraction Activities, 1990–2012

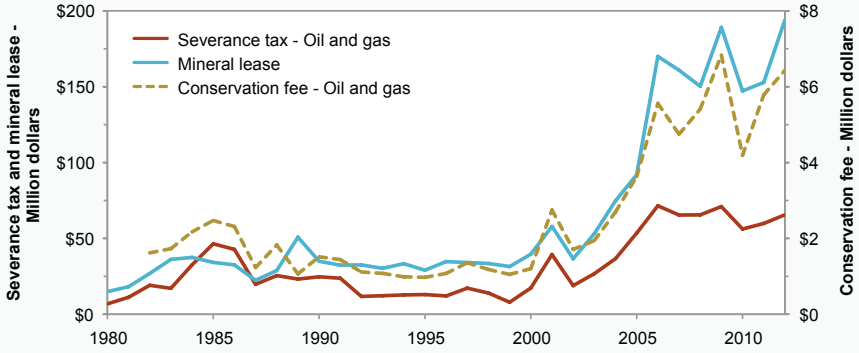


Source: Utah State Tax Commission

Note: Calendar year, presented in nominal dollars.

Property taxes charged against Utah oil and gas activities have increased more than five times since 1996, totaling nearly $57 million in 2012. Property taxes charged against coal mines have remained nearly steady for the past 10 years, averaging about $4.2 million.

Tax Collections on Oil & Gas Production in Utah and Total Mineral Lease Disbursements, 1980–2012



Source: Utah State Tax Commission

Note: State fiscal year, presented in nominal dollars.

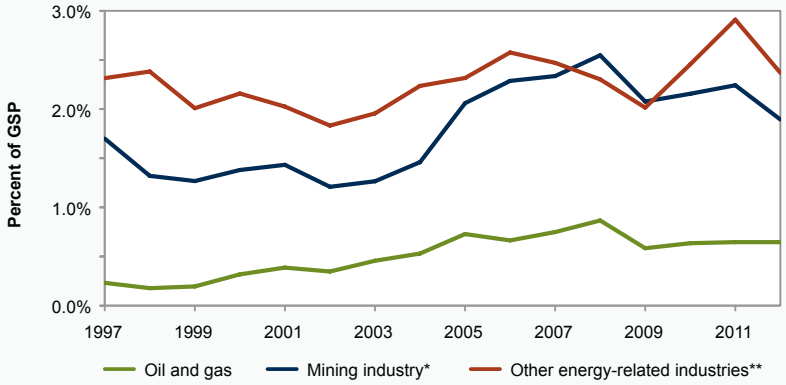
Severance tax, conservation fees, and federal mineral lease payments are all closely related to oil and gas prices, increasing significantly in the mid-2000s.

The oil and gas severance tax is based on the value at the well of oil and gas produced and saved, sold, or transported from the field where it is produced. The tax rate ranges from 3 to 5%, based on the value of the oil or gas, and is 4% for natural gas liquids.

The oil and gas conservation fee is 0.2% of the value at the well of oil, gas, and natural gas liquids produced and saved, sold, or trans-ported from the production sites.

Mineral lease disbursements from the federal government to Utah are roughly 50% (less administrative costs) of the value of minerals produced (includes minor non-energy minerals) on federal lands within the state.

Percentage of Utah's Gross State Product from Energy-Related Activities, 1997–2012

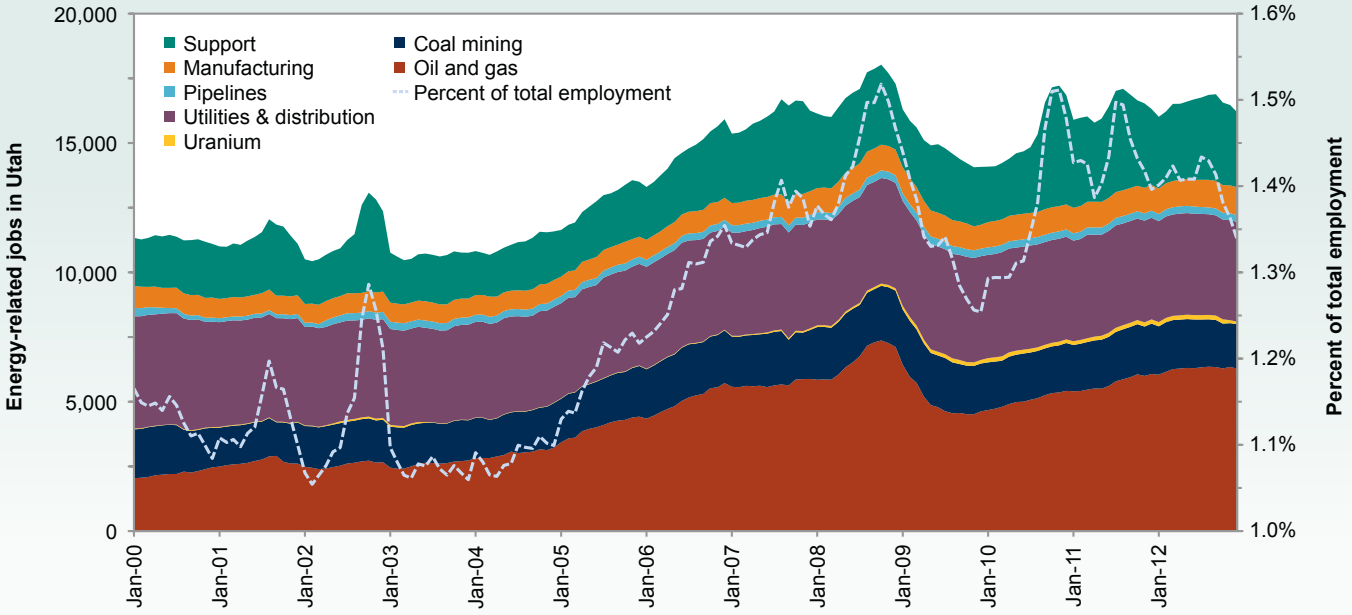


*Includes oil and gas, coal, and nonfuel mining
**Includes utilities (including non-energy-related water and sewer), pipelines, and refineries

Source: U.S. Bureau of Economic Analysis

The mining industry as a whole (including non-energy minerals) in Utah accounts for about 1.9% of the gross state product (GSP), of which the oil and gas industry accounts for about 0.7%. Utilities (including some non-energy sectors), refineries, and pipeline transportation and maintenance account for an additional 2.4% of Utah's GSP.

Direct Energy-Related Employment in Utah (monthly data), 2000–2012

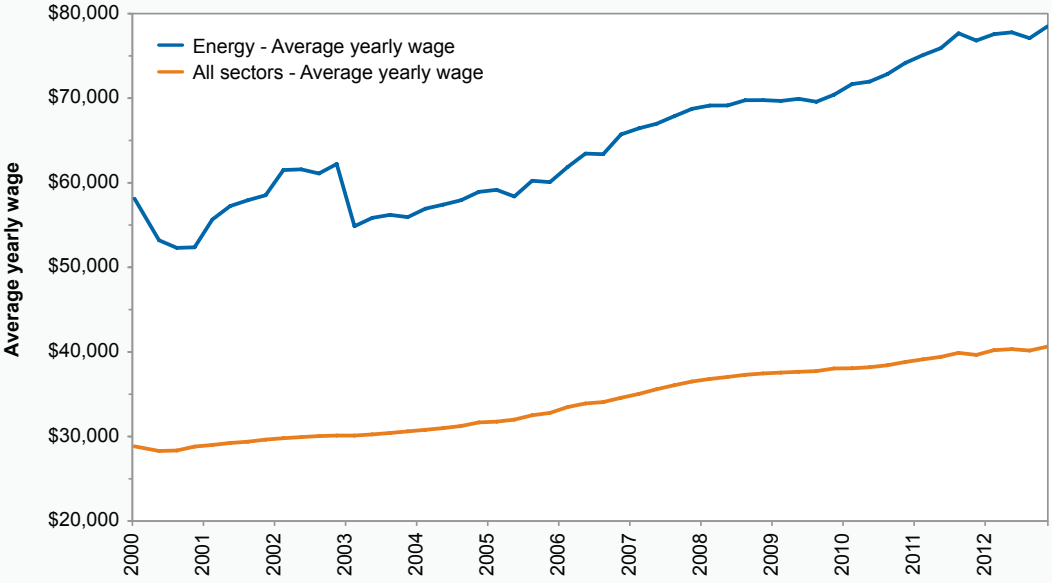


Source: Utah Department of Workforce Services

Note: Employment statistics are based on the North American Industry Classification System for businesses. While these statistics accurately capture many types of energy-related employment, they do not include employment related to renewable energy and energy efficiency, or employment in other industries that only exists because of the energy sector. For example, many renewable energy and energy-efficiency jobs are instead classified as part of a larger "construction" category. For this reason, the statistics above are a conservative estimate of energy-related employment in Utah; actual energy-related employment will be larger.

Direct energy-related employment in Utah reached 17,160 in December of 2012, of which the majority (37%) came from the oil and gas sector. Power generation (utilities and distribution) made up 22% of the total, while support industries accounted for 17%. Energy-related jobs account for just over 1.3% of total employment, increasing in recent years as the oil and gas sector expanded with increasing prices.

Annual Average Wages in Utah (quarterly data), 1990–2012

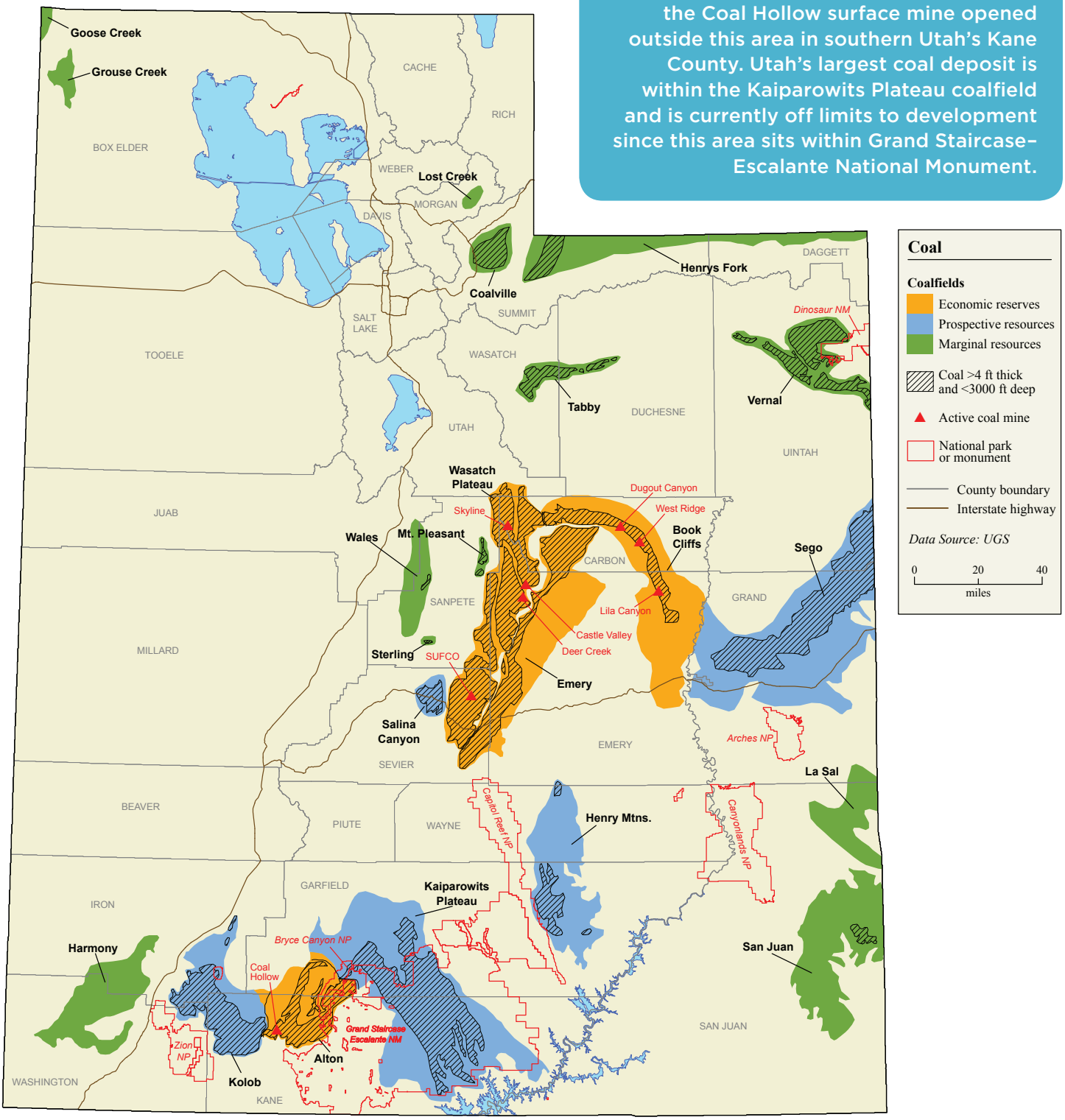


Average yearly wages in the energy sector ($77,735 in 2012) are nearly double the statewide average annual wage ($40,332 in 2012).

Source: Utah Department of Workforce Services

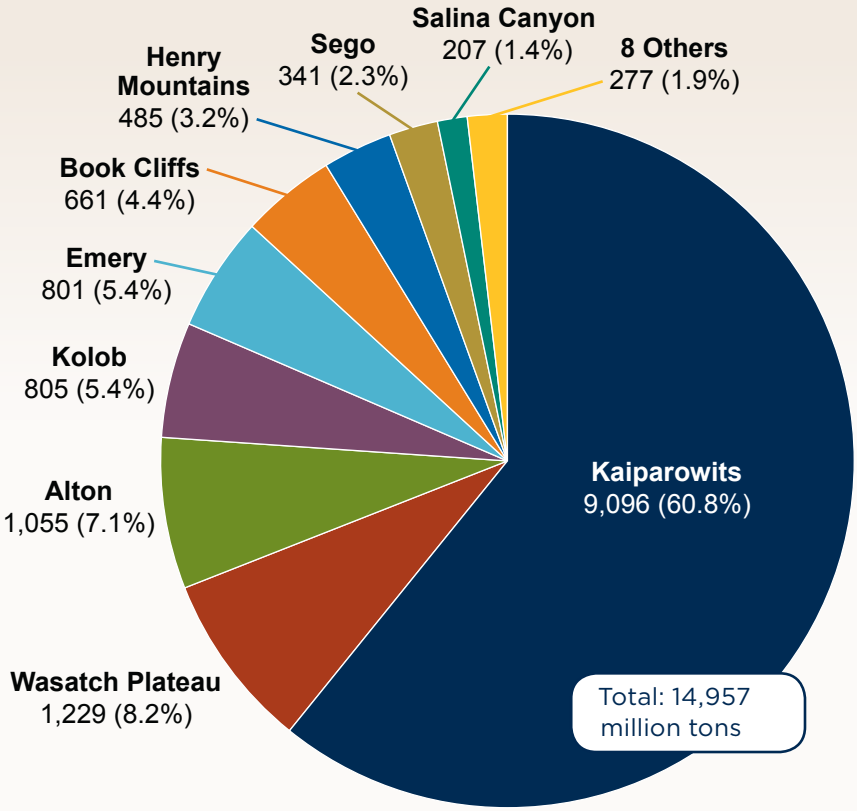
coal

Utah's most economic coal reserves are located in three coalfields forming an inverted "U" primarily across Sevier, Emery, and Carbon Counties. Recently, the Coal Hollow surface mine opened outside this area in southern Utah's Kane County. Utah's largest coal deposit is within the Kaiparowits Plateau coalfield and is currently off limits to development since this area sits within Grand Staircase–Escalante National Monument.



Utah's Recoverable Coal Resources by Coalfield, 2012

Million tons (Percent of total)



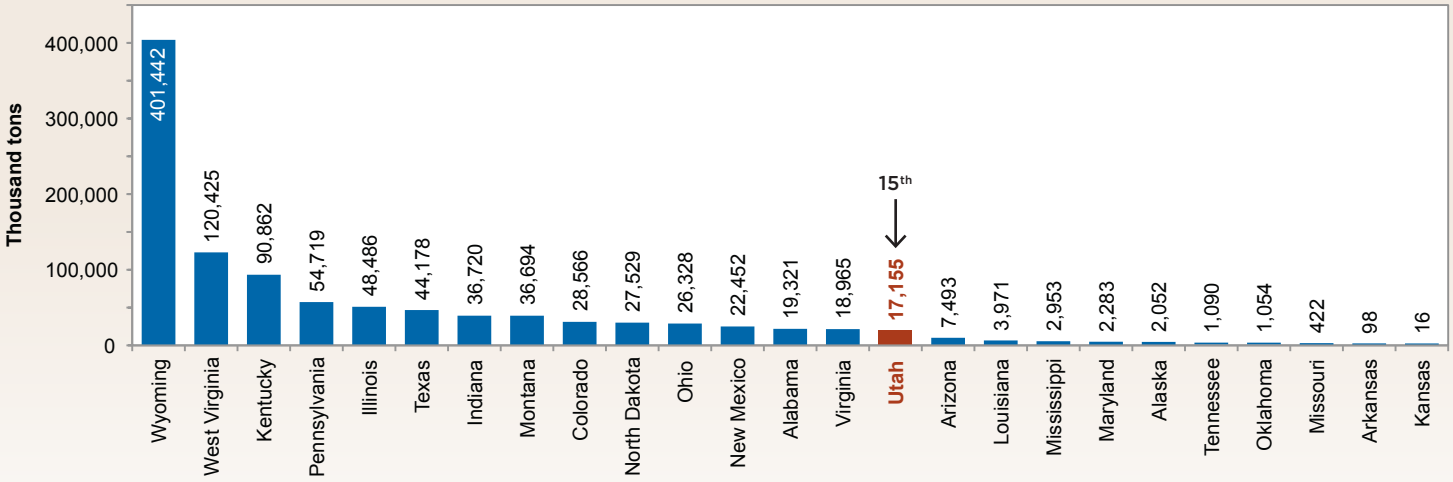
The majority of Utah's recoverable coal resources are located in the Grand Staircase–Escalante National Monument within the Kaiparowits coalfield (60.8% of Utah's estimated recoverable coal, as of 2012). Only the Wasatch Plateau, Book Cliffs, and Alton fields currently contain active mines.

UEMS website table: Table 2.3 | Source: UGS

Note: For Wasatch Plateau, Alton, Emery, Book Cliffs, and Henry Mountains, resources were constrained by a seam height minimum of four feet, with no more than 3000 feet of cover. For the remaining fields, resources were constrained by an estimated resource factor ranging from 30% to 40% of principal (unconstrained) resources. These resources do not take into account economic or land use constraints.

Utah coal

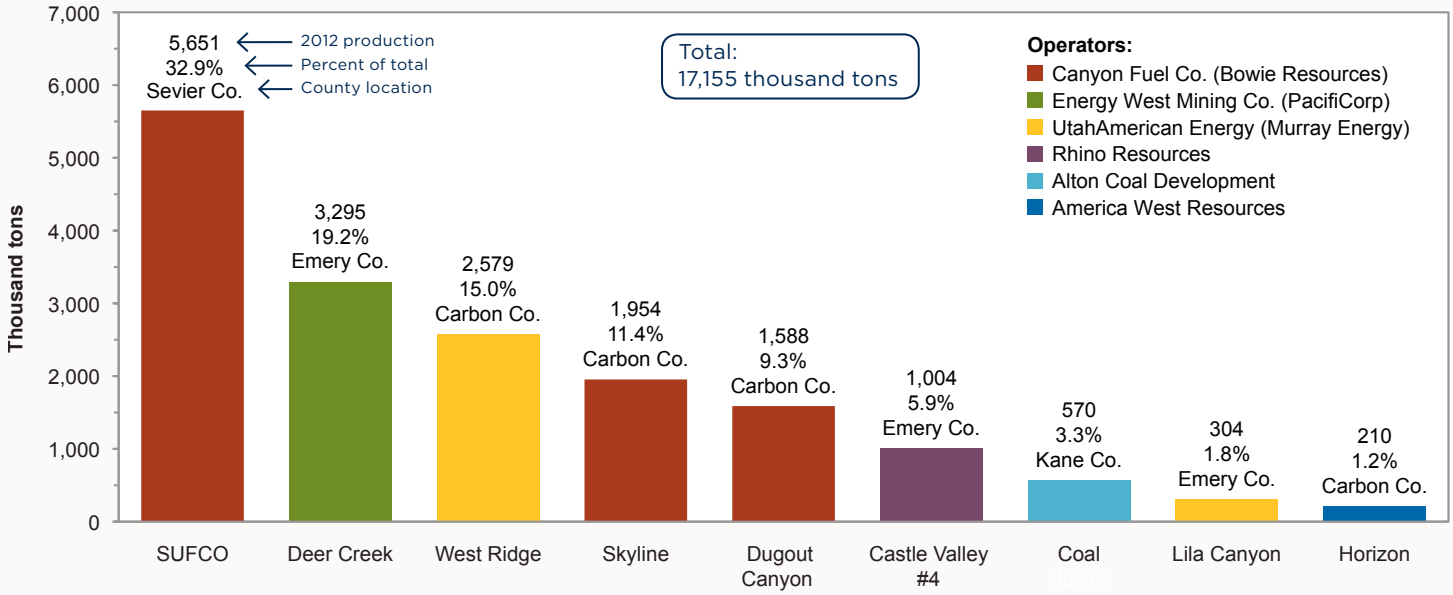
U.S. Coal Production by State, 2012



In 2012, Utah ranked as the 15th largest producer of coal in the United States.

UEMS website table: Table 2.7 | Source: EIA, UGS

Utah Coal Production by Mine, 2012



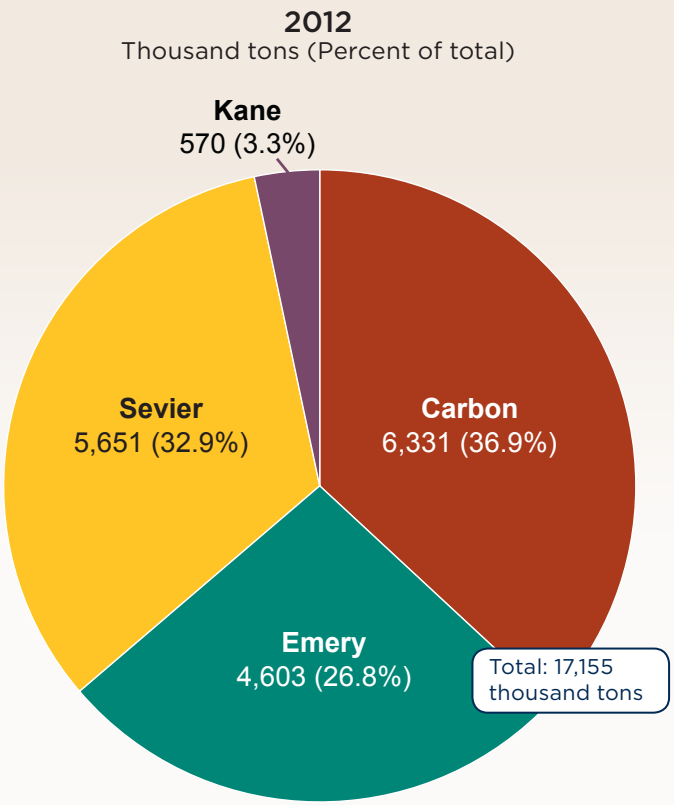
In 2012, 54% of Utah's coal production came from Canyon Fuel Company mines (Bowie Resources) located in Sevier and Carbon Counties. The Horizon mine closed in mid-2012 after declaring bankruptcy. The Lila Canyon mine opened in 2010 and the Coal Hollow mine opened in 2011; both mines have yet to reach full production.

UEMS website table: Table 2.8 | Source: UGS

Utah Coal Production by County

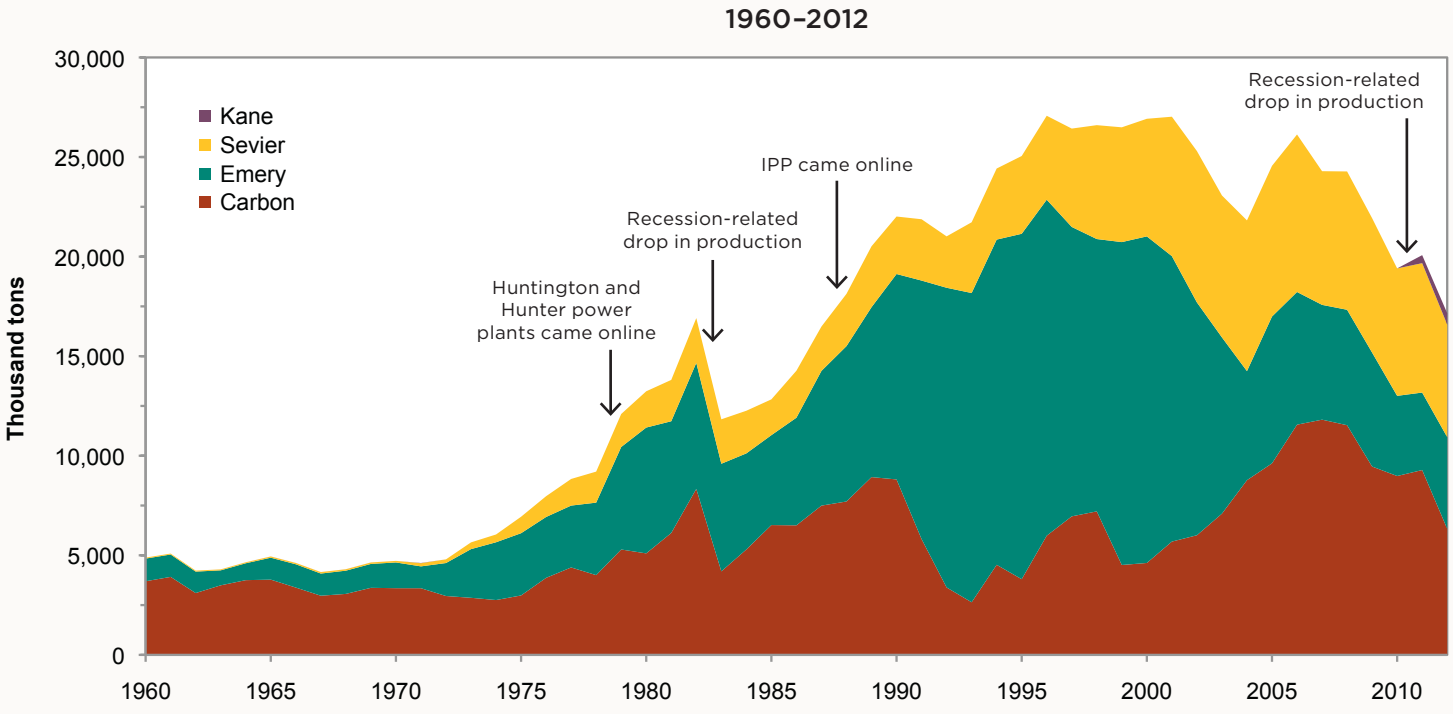
2013 Update

Coal production in Utah totaled 16,953 thousand tons in 2013, with production forecasted to remain at this level for at least the next several years.



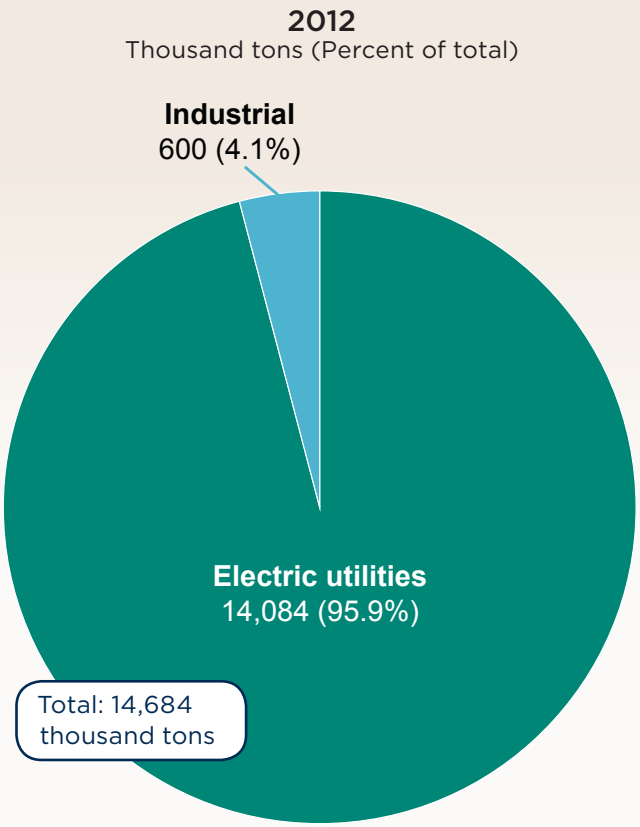
UEMS website table: Table 2.10 | Source: UGS

In recent years, coal production has declined in all Utah counties, mostly due to the recent economic recession, creating less demand at electric utilities and industrial users. Carbon County mines, namely Dugout, West Ridge, and Skyline, account for over one-third of Utah's total production. Only one large mine, Deer Creek, remains in Emery County, while the only coal produced in Sevier County is from the SUFCO mine. In the next few years, the percentage of coal mined from Emery County will increase as the Lila Canyon mine ramps up to full longwall production and mines in Carbon County deplete their reserves. Beginning in 2011, the first significant production outside central Utah started at the Coal Hollow mine in Kane County.



Note: Production too small to be seen on graph was reported from Summit and Iron Counties, mostly between 1960 and 1972.

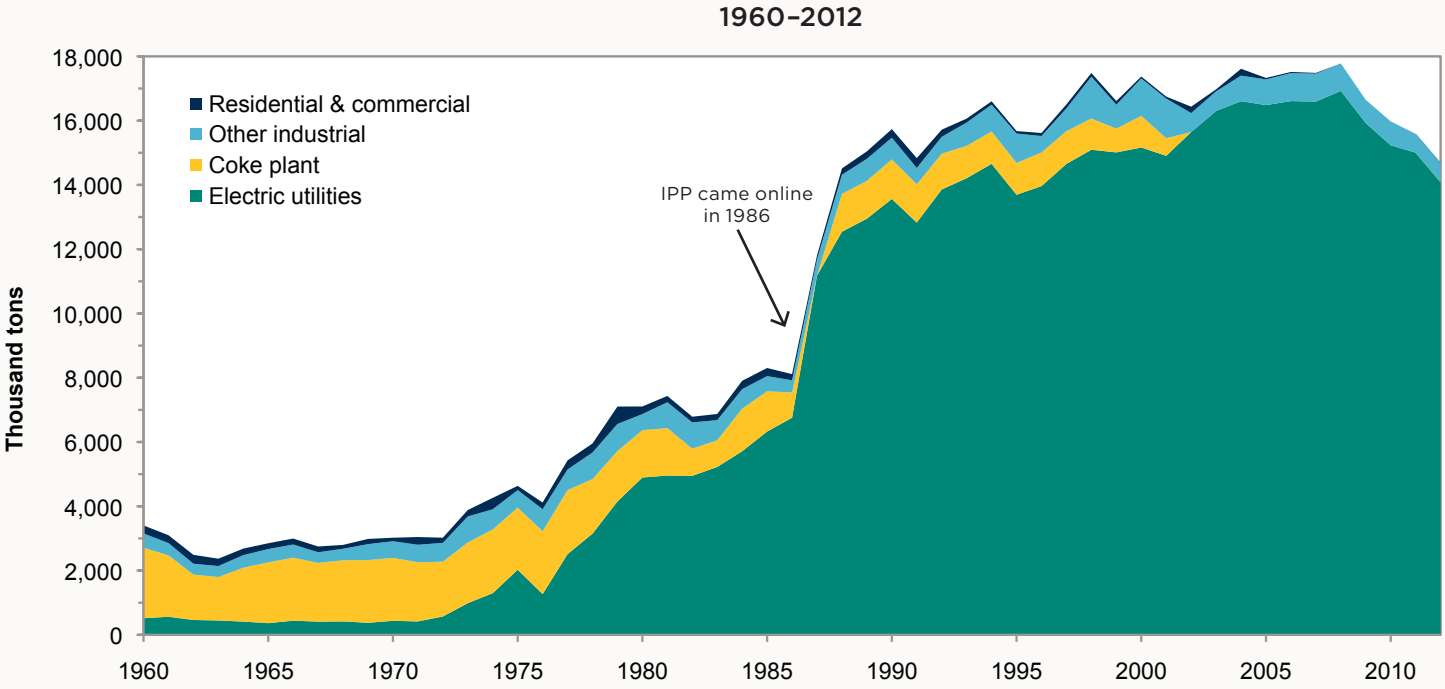
Utah Coal Consumption by Sector



UEMS website table: Table 2.21 | Source: EIA, UGS

The vast majority of coal consumed in Utah (95.9%) is used at electric power plants. The remaining coal (4.1%) is consumed by the industrial sector at cement/lime plants and Kennecott Utah Copper's power plant (182 megawatt capacity) which provides electricity for copper smelting. Coke consumption ceased in 2001 when Geneva Steel went out of business and consumption in the residential and commercial sectors has become negligible in recent years.

Hunter coal-fired power plant

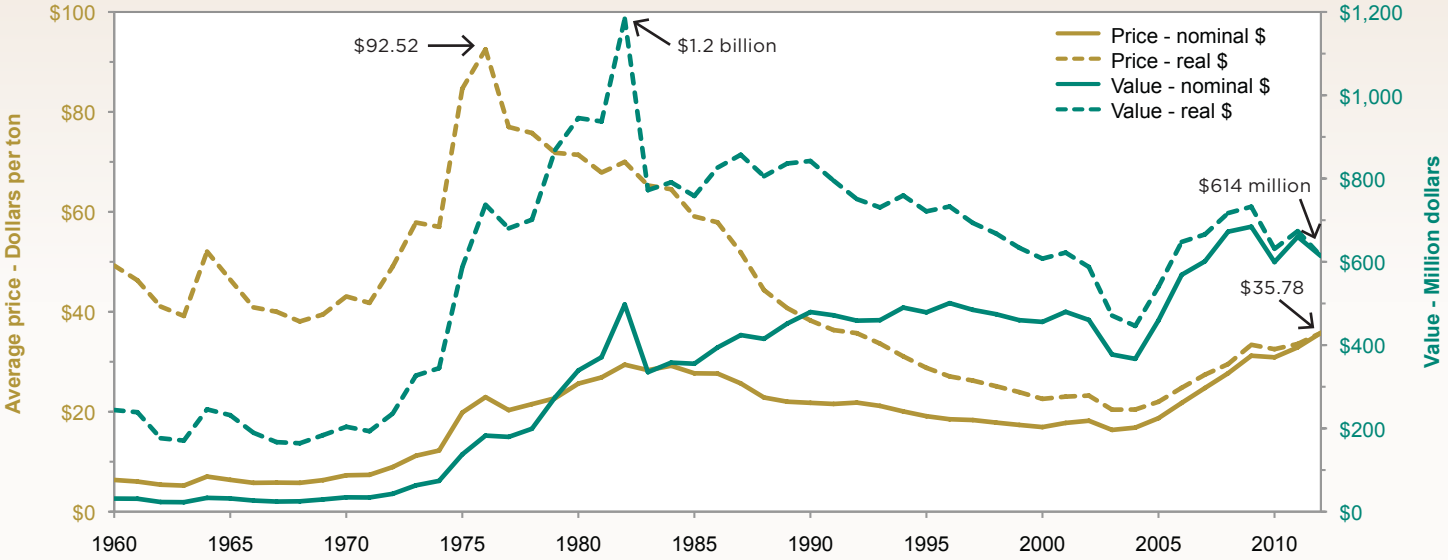


Utah's minemouth price (the price at the mine) of $35.78 per ton in 2012 was the highest nominal price in history, but was well below the real (inflation-adjusted) high of $93 reached in 1976. The 2012 value of produced Utah coal equaled $614 million, the 4th highest in nominal dollars, but much less than the inflation-adjusted value of $1.2 billion recorded in 1982.

2013 Update

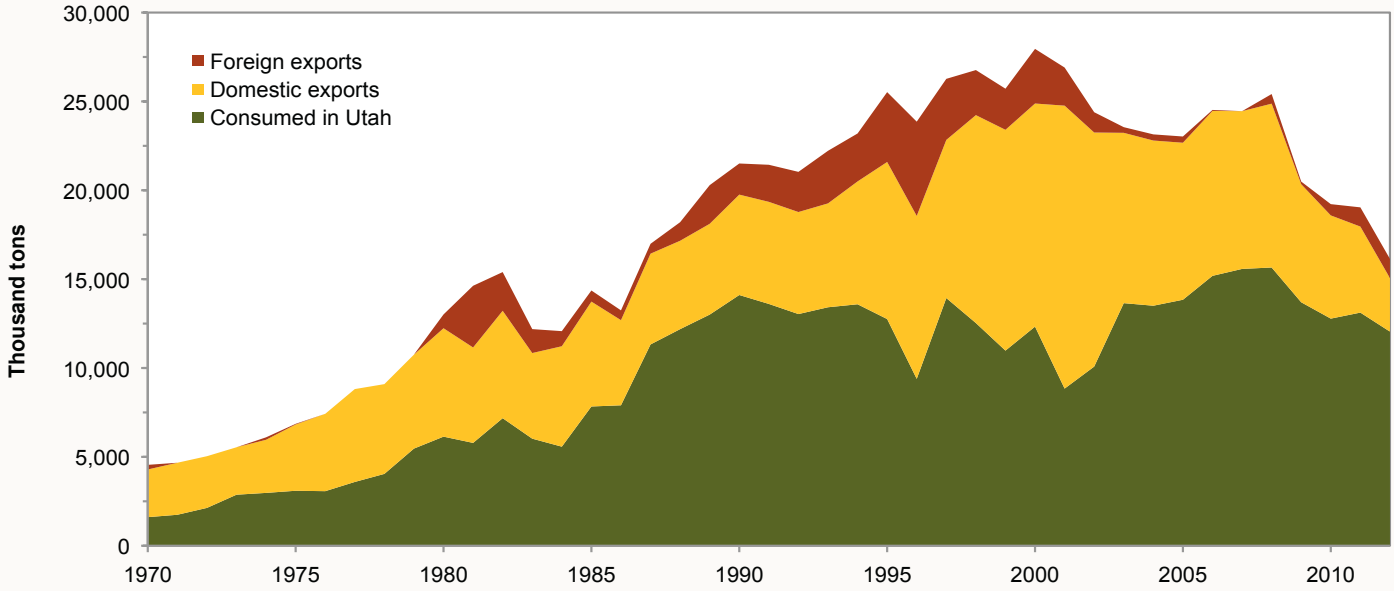
The average price of coal dropped to $34.17 in 2013 and had an overall value of $579 million.

Average Minemouth Price and Value of Utah Coal, 1960–2012



UEMS website table: Table 2.22 | Source: UGS

Distribution of Utah Coal, 1970–2012

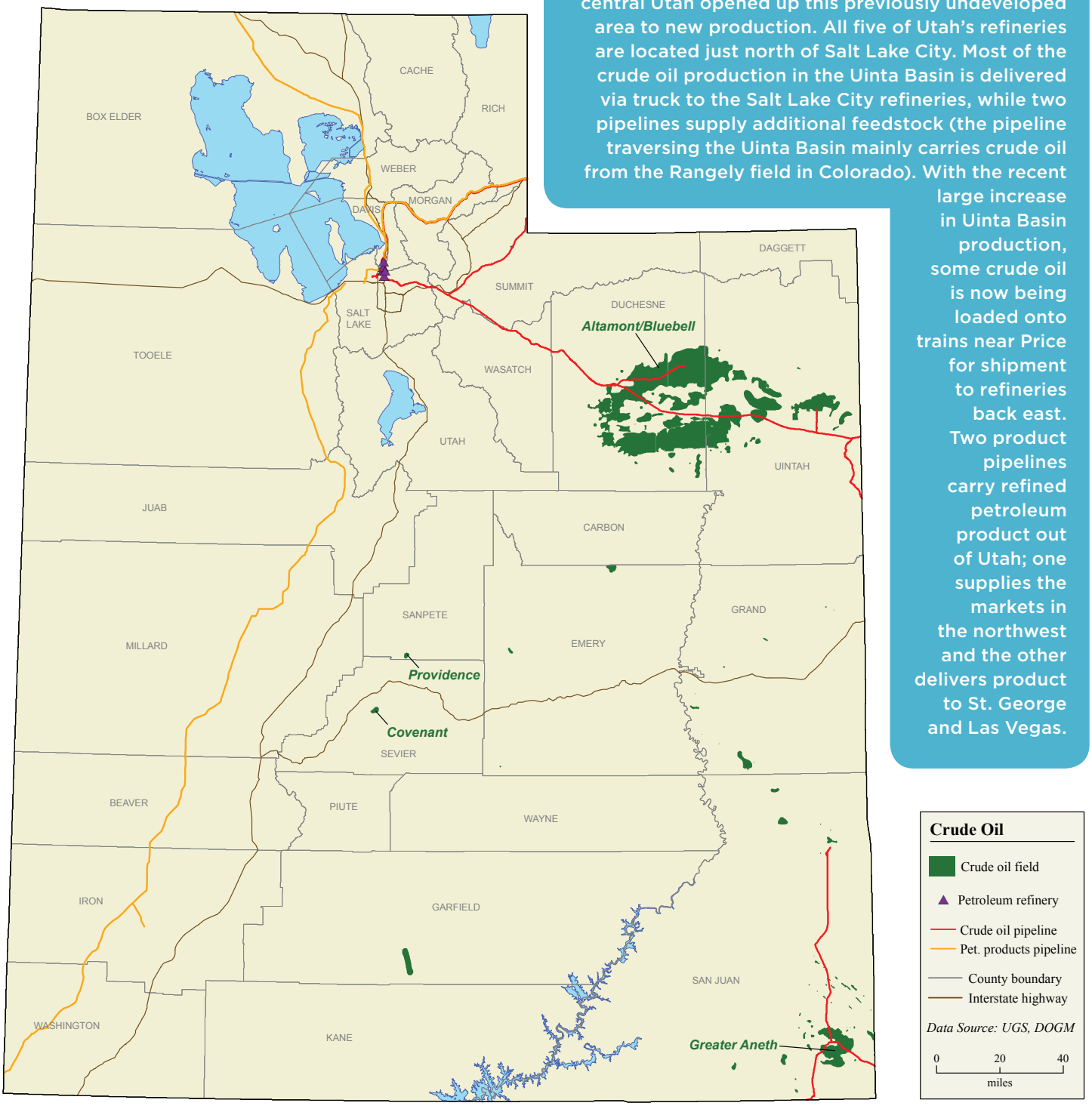


The majority of Utah coal, 75% in 2012, is used in state, while 19% was shipped out of state, and 7% was shipped to other countries. Foreign exports, mostly to Asia, peaked in 1996 when 5.5 million tons or 20% of Utah coal was shipped to foreign markets. Domestic exports have decreased in recent years as several electric plants and industrial users in California and Nevada have switched to natural gas.

UEMS website table: Table 2.19 | Source: UGS

crude oil & petroleum products

Utah's crude oil production is mostly concentrated within Duchesne and Uintah Counties to the north and San Juan County to the south. The 2004 discovery of the Covenant field, and later the Providence field, in central Utah opened up this previously undeveloped area to new production. All five of Utah's refineries are located just north of Salt Lake City. Most of the crude oil production in the Uinta Basin is delivered via truck to the Salt Lake City refineries, while two pipelines supply additional feedstock (the pipeline traversing the Uinta Basin mainly carries crude oil from the Rangely field in Colorado). With the recent large increase in Uinta Basin production, some crude oil is now being loaded onto trains near Price for shipment to refineries back east. Two product pipelines carry refined petroleum product out of Utah; one supplies the markets in the northwest and the other delivers product to St. George and Las Vegas.

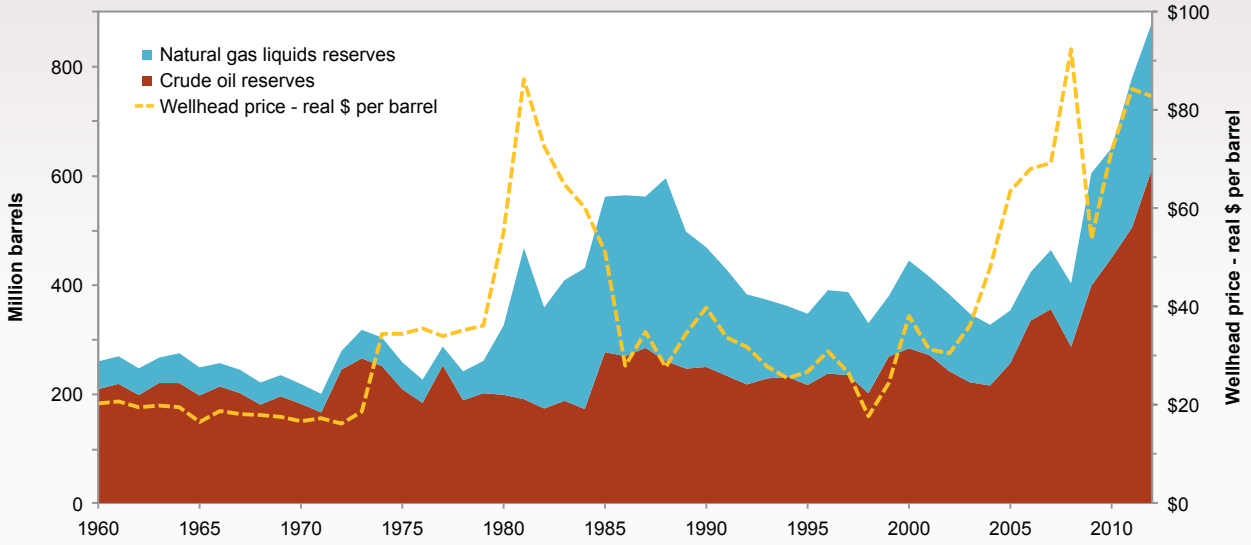


Natural gas liquids (NGL) reserves increased in 1979, coinciding with a spike in oil prices, and peaked in the late 1980s. The recent increase in crude oil and NGL reserves again reflects record high prices, and is directly related to the increased potential in the Uinta Basin.

2013 Update

Approximately 965 wells are estimated to have been completed in 2013, 68% of which are oil wells.

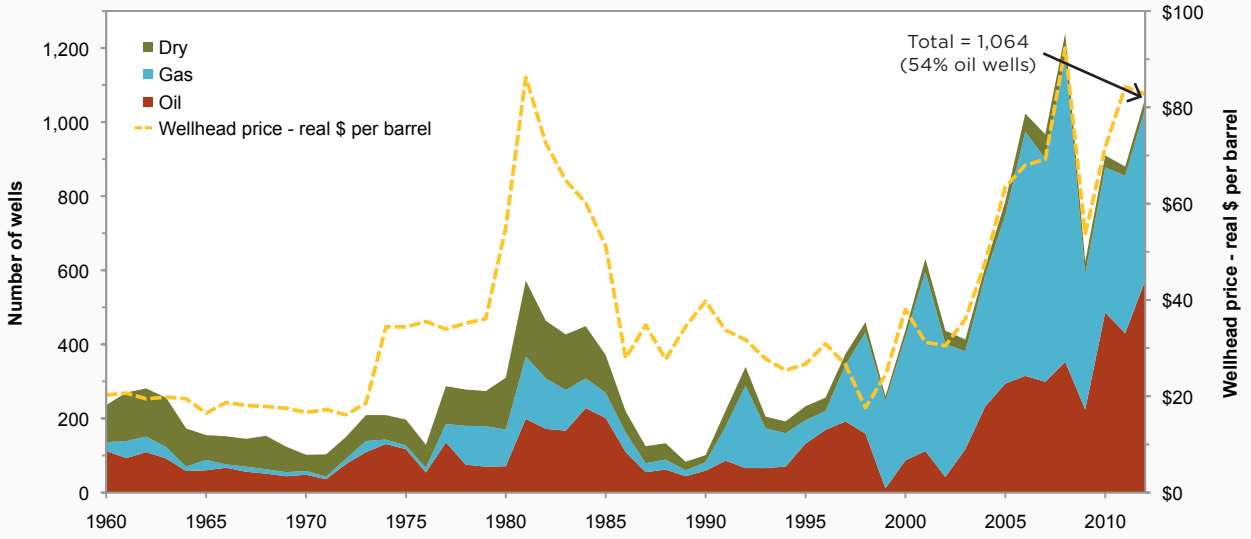
Crude Oil and Natural Gas Liquid Reserves in Utah, 1960–2012



UEMS website table: Table 3.2 and Table 3.19 | Source: EIA

The number of well completions (both oil and gas) has tracked closely with wellhead price, both peaking in the early 1980s and again in recent years. The recent increase in crude oil drilling compared with natural gas drilling reflects a relative disparity in prices. Also noteworthy is the decrease in the number of dry wells through the years as drilling and exploration techniques have improved and high-risk wildcat drilling has decreased.

Oil and Gas Well Completions in Utah, 1960–2012



UEMS website table: Table 3.4 and Table 3.19 | Source: DOGM, EIA

2013 Update

Crude oil production in Utah totaled approximately 34,900 thousand barrels in 2013, with a continued upward trend expected in the future.

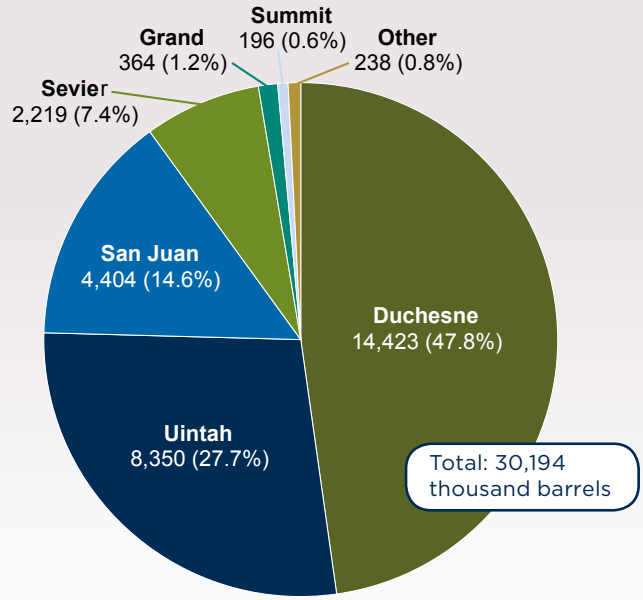
Crude oil production in Utah is mostly concentrated in Duchesne, Uintah, and San Juan Counties. Sevier County production started in 2004 with the discovery of the Covenant field.

UEMS website table: Table 3.7 | Source: DOGM

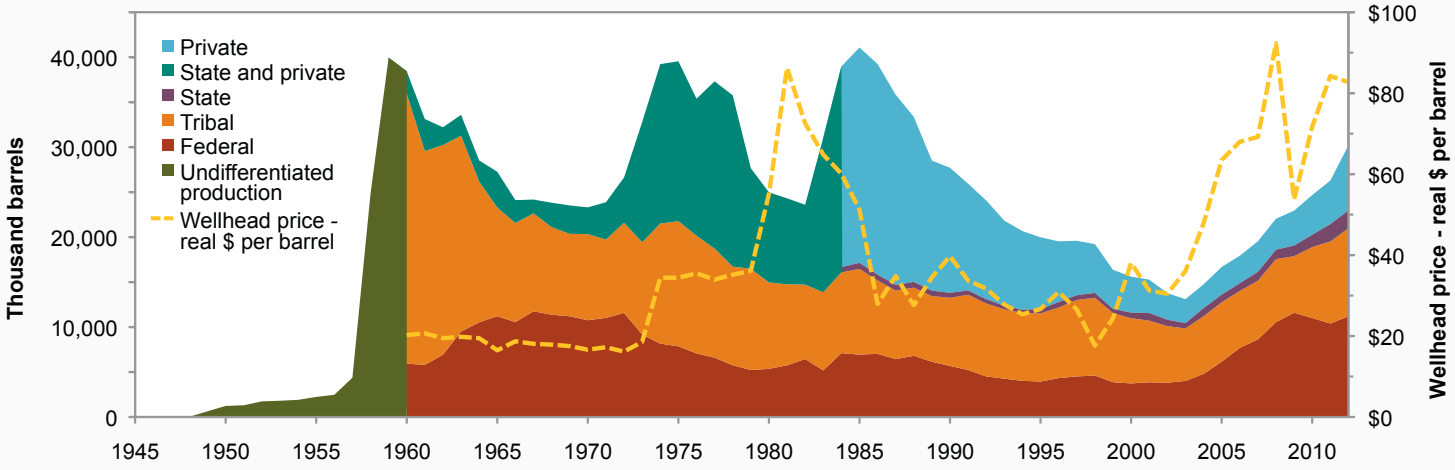
Note: "Other" includes Garfield, Carbon, Emery, and Daggett Counties.

Utah Crude Oil Production by County, 2012

Thousand barrels (Percent of total)



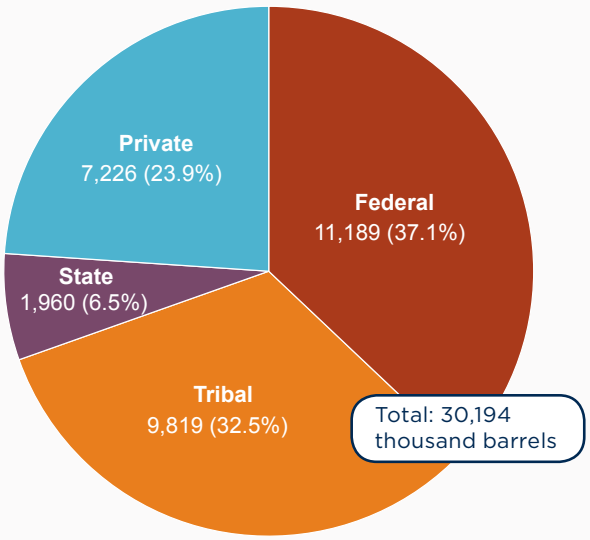
Utah Crude Oil Production by Landownership, 1945–2012



Utah has experienced three oil booms in the past 60 years and is currently defining a fourth. The first spike in crude oil production followed the discovery of the very large Bluebell and Greater Aneth fields (mostly tribal lands) in 1955 and 1956, respectively. The second spike coincided with a 1971 increase in wellhead price as well as the discovery of the Altamont field (mostly private land). The third peak in production resulted from the price spike of the early 1980s and followed the 1980 discovery of the Anschutz Ranch East natural gas field, which also produced large amounts of crude oil (again, most new production was from private land). The current rise in crude oil production is related to higher prices resulting in higher production from existing fields, new field discoveries in the Uinta Basin, and the discovery of the Covenant field in central Utah.

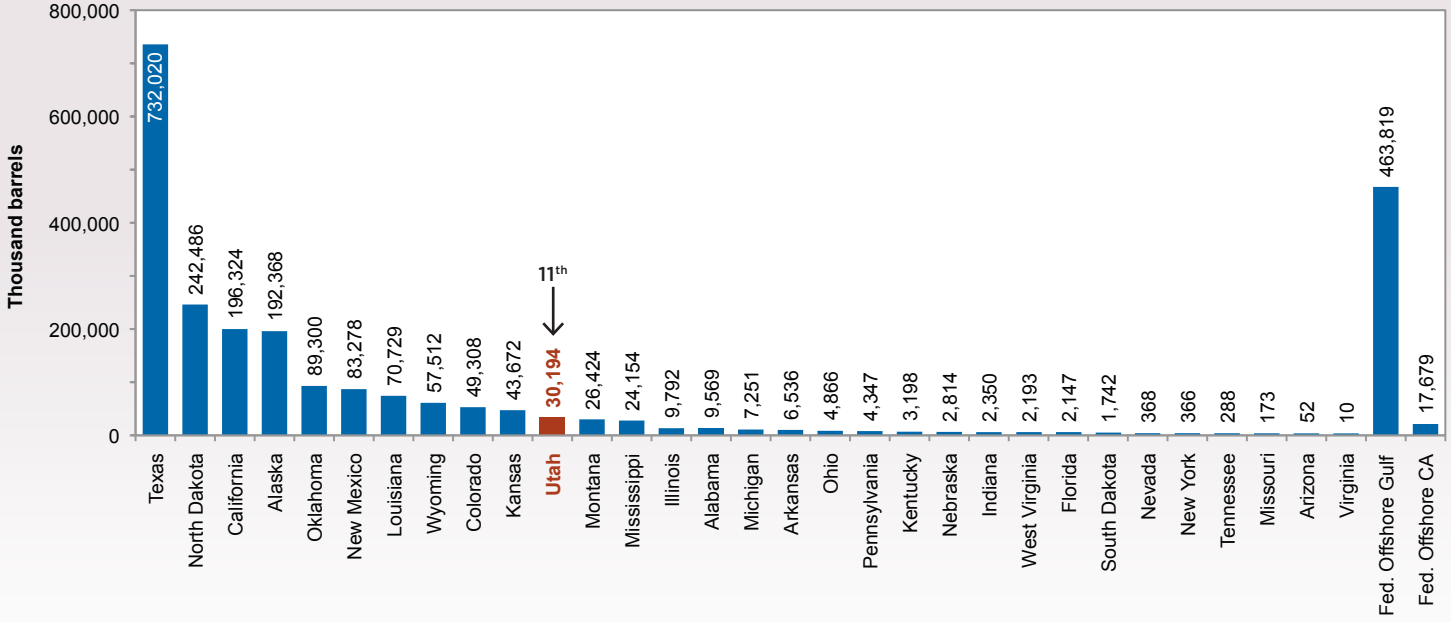
2012

Thousand barrels (Percent of total)



UEMS website table: Table 3.6 and Table 3.19 | Source: DOGM, EIA

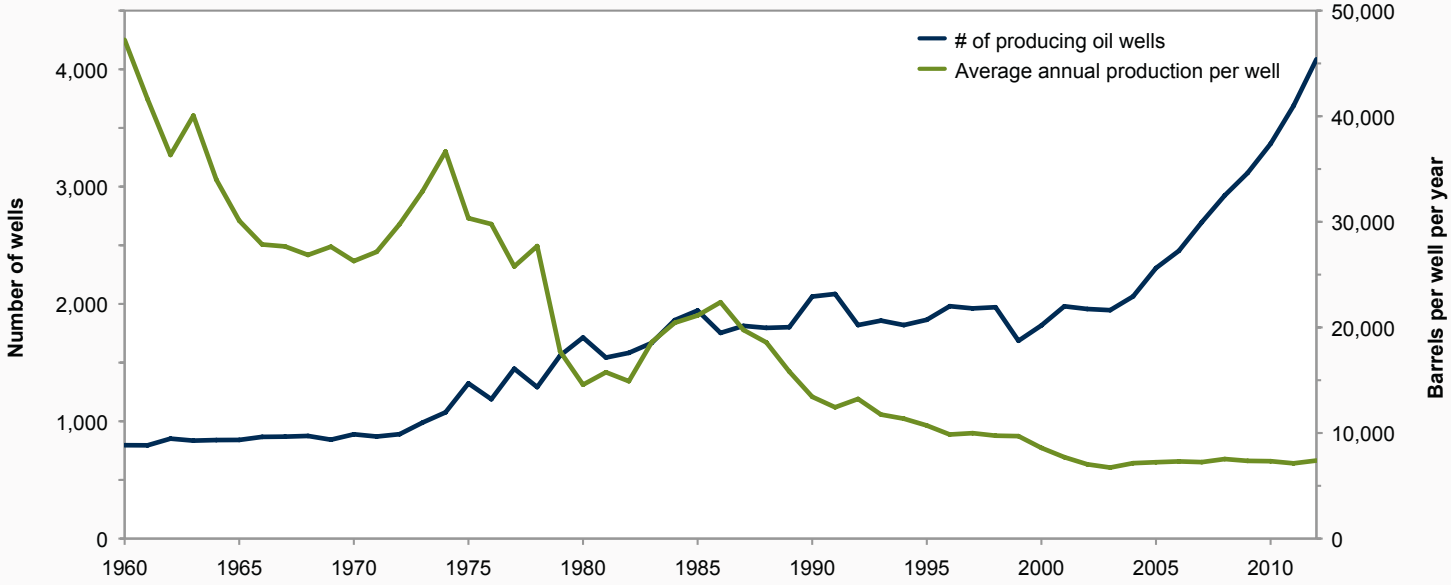
U.S. Crude Oil Production by State, 2012



In 2012, Utah ranked as the 11th largest producer of crude oil in the United States (not including federal offshore areas).

UEMS website table: Table 3.5 | Source: EIA, DOGM

Number of Producing Crude Oil Wells in Utah Versus Average Annual Production per Well, 1960–2012



As the total number of producing oil wells has increased over the years, the average annual production per well has decreased. This graph illustrates that more wells are now required to produce the same amount of crude oil.

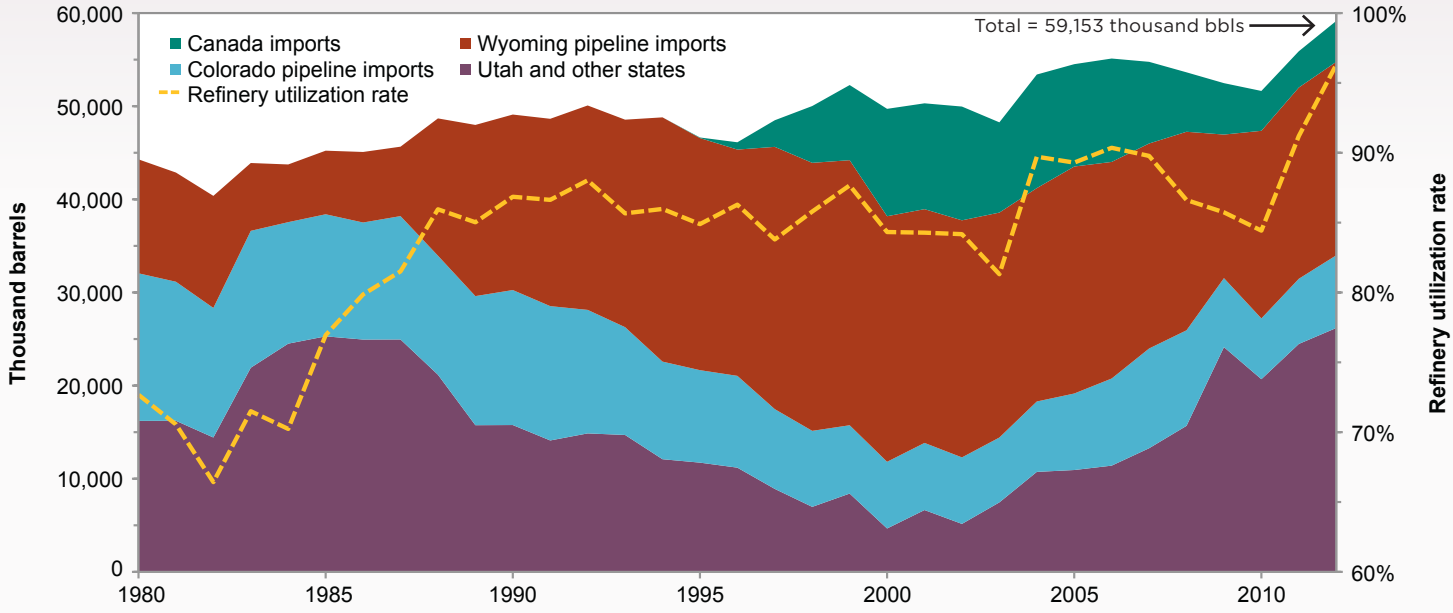
UEMS website table: Table 3.6 | Source: DOGM

2013 Update

Utah refineries received 57,345 thousand barrels of crude oil in 2013, 5% of which came from Canada.

In 2012, Utah refineries received a record amount of crude oil, totaling 59,153 thousand barrels, from four main sources: Utah, Colorado, Wyoming, and Canada. In 2004, 23% of refinery receipts came from Canada, but with the recent increase in Utah crude oil production, the percentage from Canada has dropped to just 7%. Utah's refinery utilization rate, the average ratio of crude oil inputs to total refinery capacity, has averaged 87% over the past 20 years. In 2012, the utilization rate was about 96%, the highest since 1971.

Origin of Crude Oil Shipped to Utah Refineries, 1980–2012

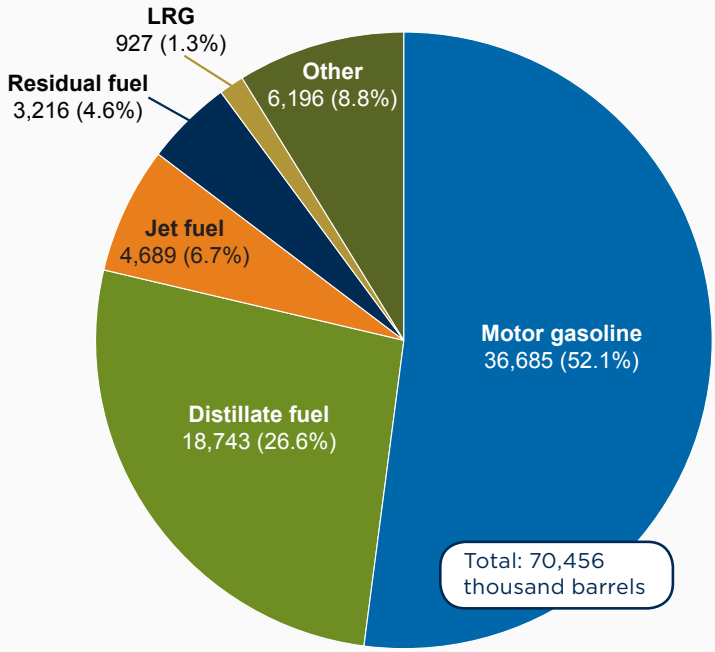


UEMS website table: Table 3.14 and Table 3.16 | Source: EIA, UGS

Note: Pipeline imports are known; however, deliveries via truck are difficult to track.

Utah Refinery Production by Product, 2012

Thousand barrels (Percent of total)

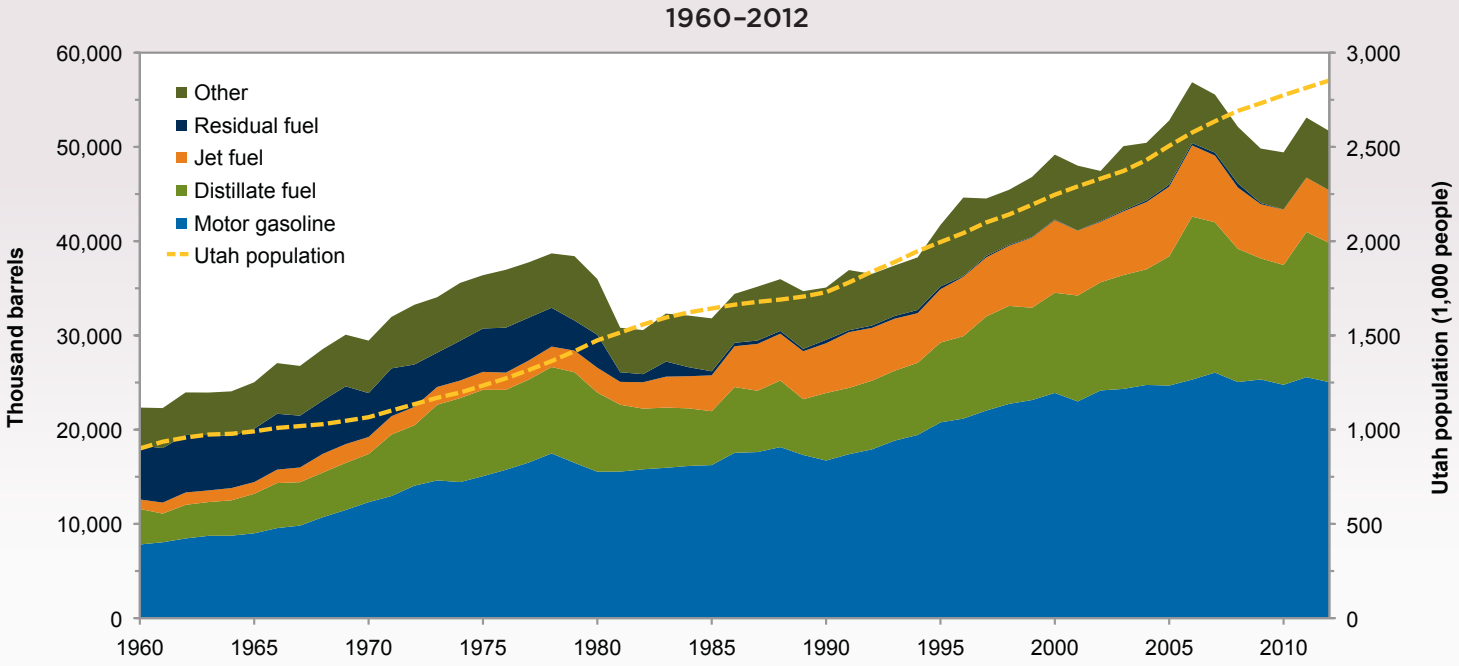


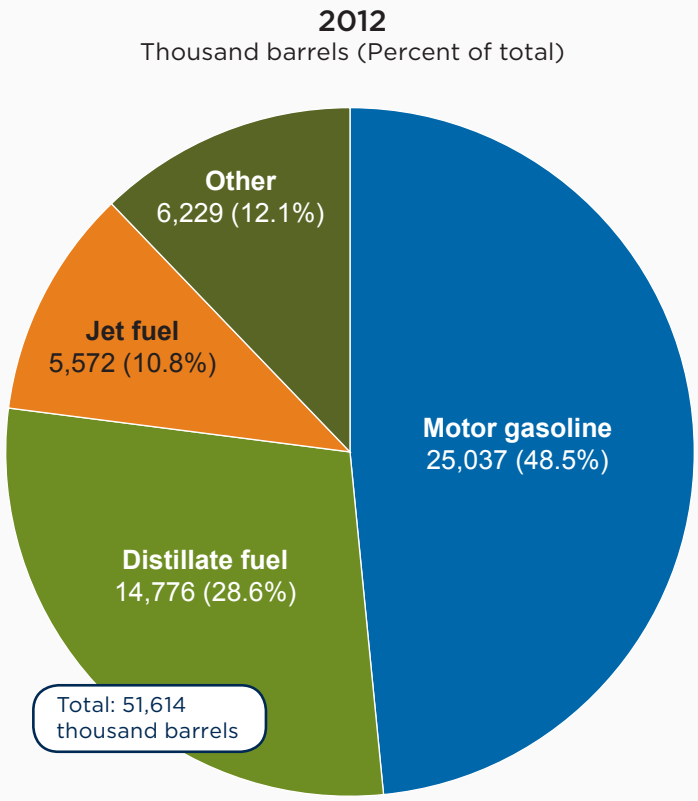
Utah refineries produced nearly 37 million barrels of motor gasoline in 2012, of which roughly 12 million barrels were shipped to surrounding states.

UEMS website table: Table 3.15 | Source: EIA

Note: LRG = liquefied refinery gases

Consumption of Petroleum Products in Utah





Motor gasoline was the most used petroleum product in 2012, accounting for 48.5% of all consumption. Distillate fuel ranked second at 28.6%, followed by jet fuel at 10.8%. Residual fuel use has declined greatly since the mid-1980s since it is no longer used as a fuel in power plants. Petroleum product consumption peaked in 2006 and has declined the past three years due to higher prices and the economic downturn, rebounding briefly in 2011. Overall petroleum product consumption tracks well with Utah's population growth.

UEMS website table: Table 3.17 | Source: EIA

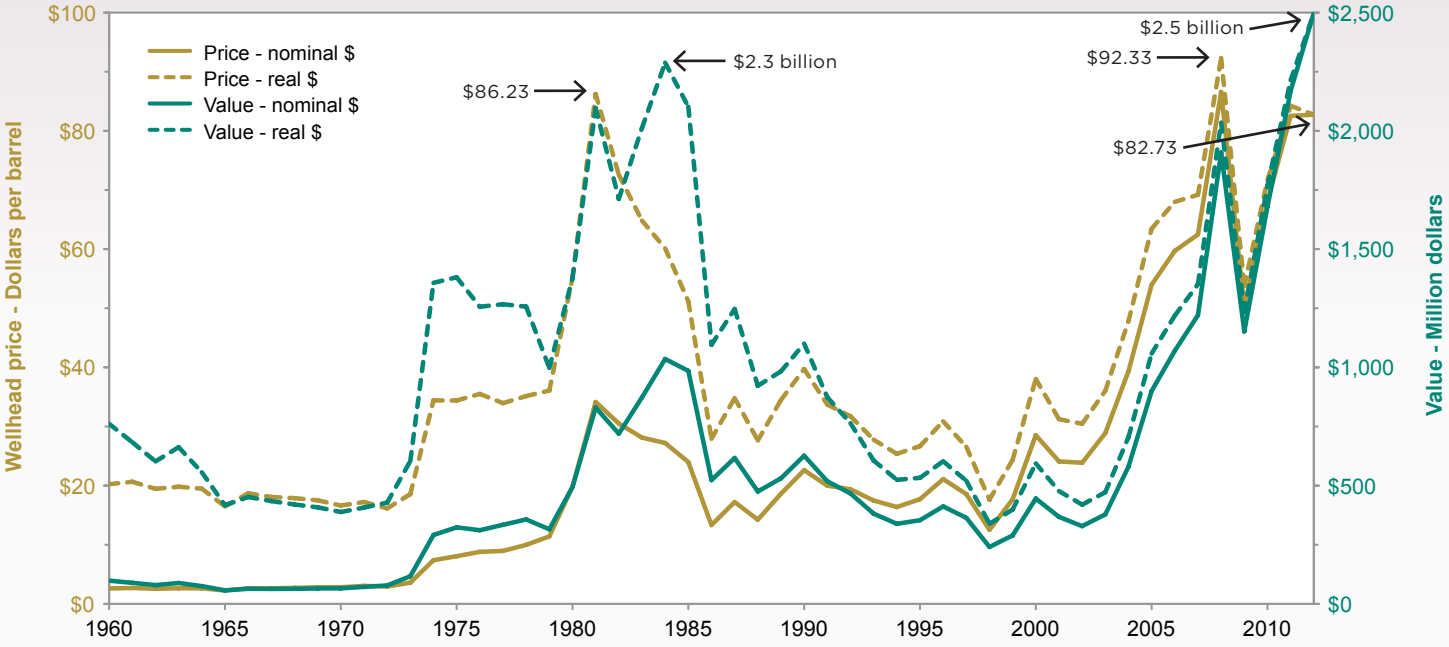
Note: "Other" includes asphalt and road oil, aviation gasoline, kerosene, liquefied petroleum gases, lubricants, among others.

2013 Update

Utah's crude oil wellhead price averaged $84.78 per barrel in 2013.

Utah's crude oil wellhead price hit an all-time, inflation-adjusted high of $92.33 per barrel in 2008. After a recession-related drop in 2009 and 2010, prices rebounded back into the low-$80s, averaging $82.73 in 2012. The value of Utah's crude oil reached $2.5 billion in 2012, a record high even when accounting for inflation.

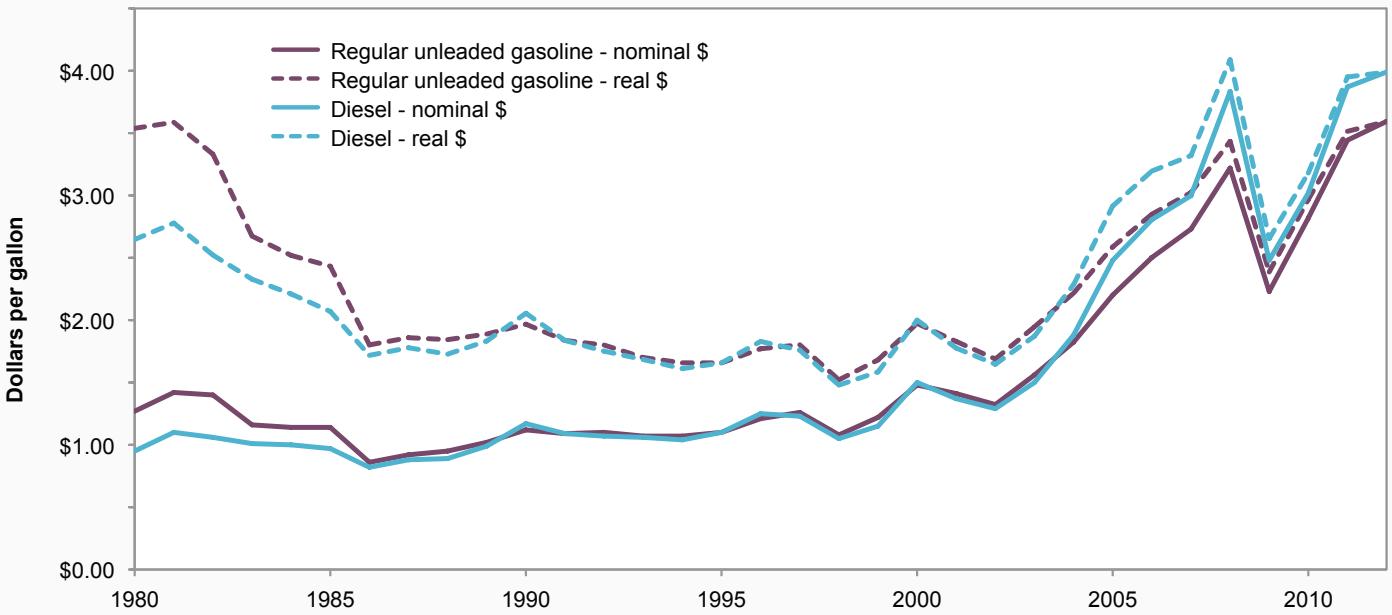
Average Wellhead Price and Value of Crude Oil in Utah, 1960–2012



UEMS website table: Table 3.19 | Source: EIA

Regular unleaded gasoline and diesel prices have rebounded in recent years after a dramatic recession-related drop in 2009, averaging $3.59 and $3.99 per gallon, respectively, in 2012.

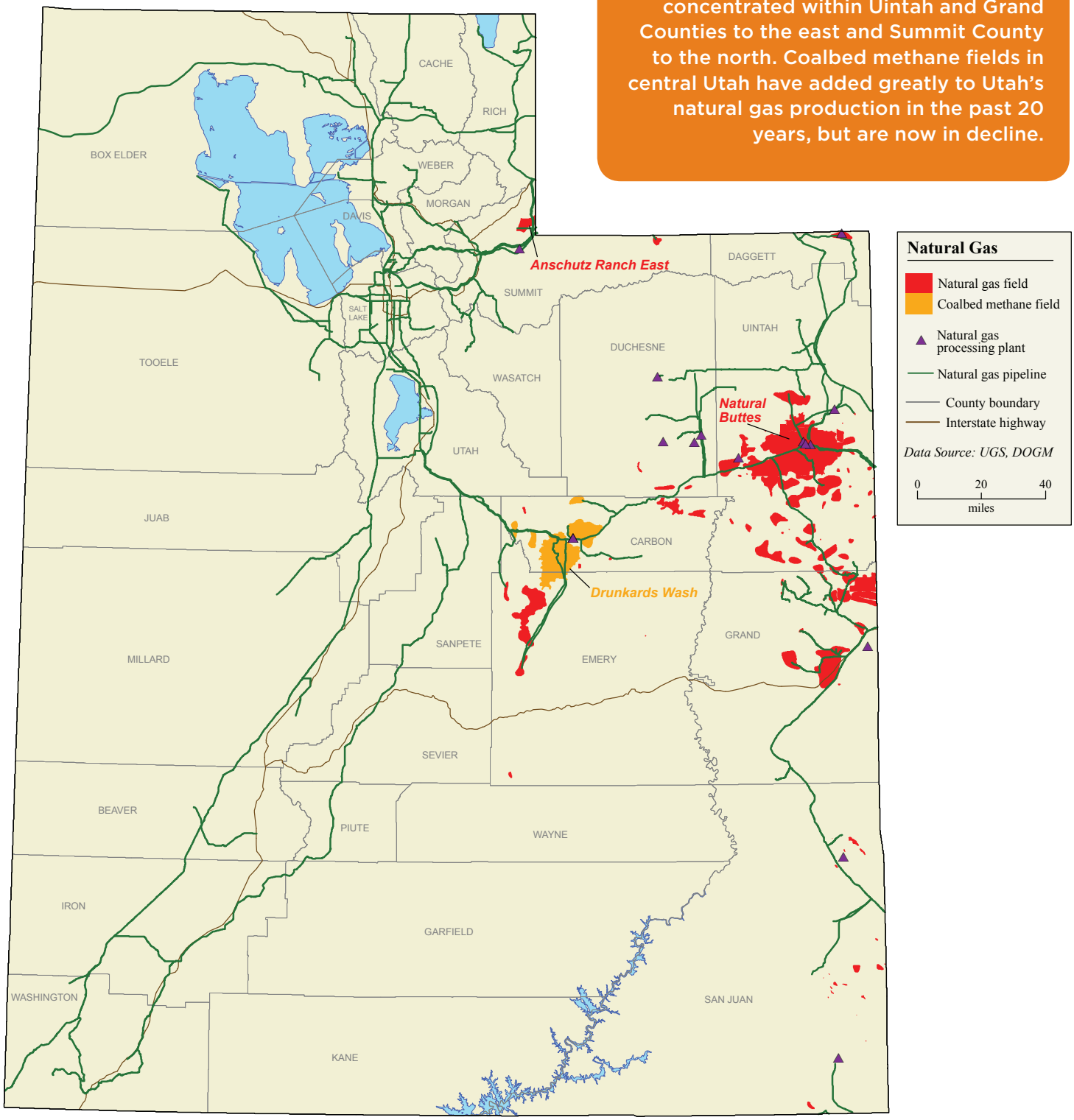
Utah Price of Motor Gasoline and Diesel, 1980–2012



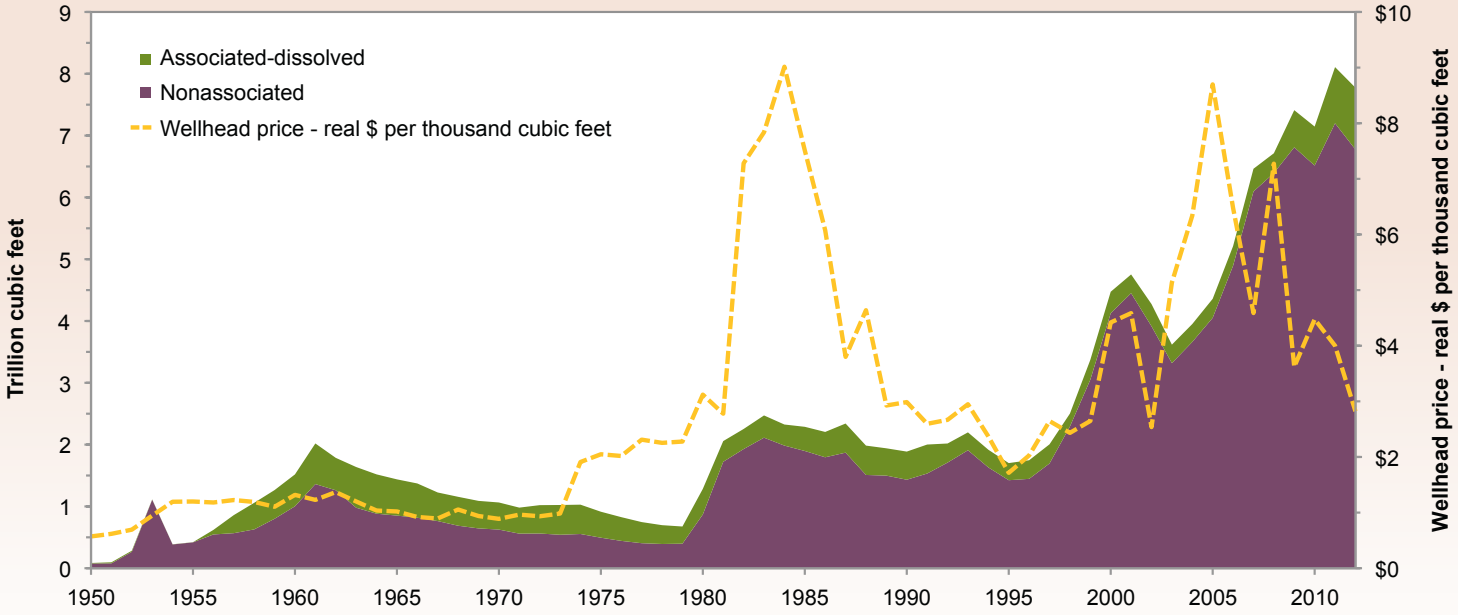
Source: EIA

natural gas

Utah's natural gas production is mostly concentrated within Uintah and Grand Counties to the east and Summit County to the north. Coalbed methane fields in central Utah have added greatly to Utah's natural gas production in the past 20 years, but are now in decline.



Natural Gas Reserves in Utah, 1950–2012



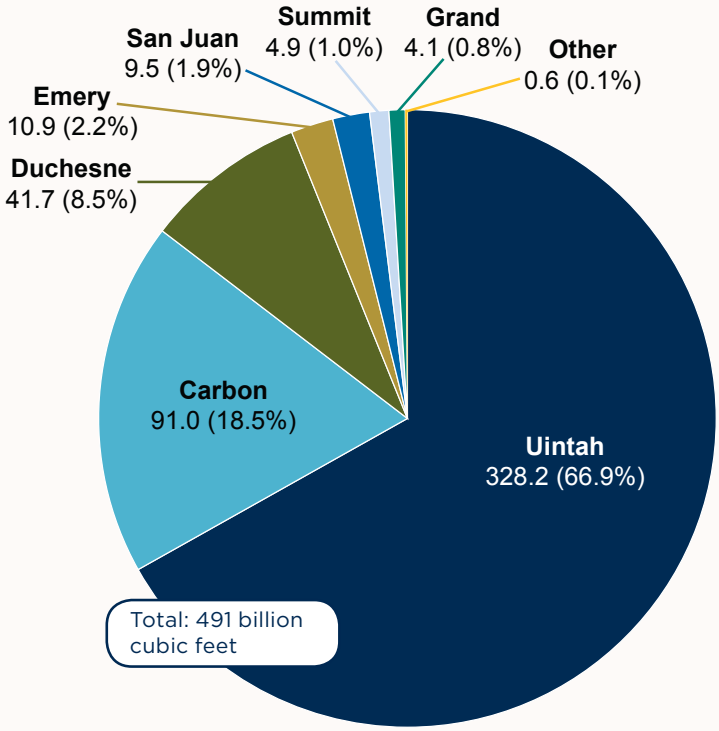
UEMS website table: Table 4.2 and Table 4.15 | Source: EIA

Note: Nonassociated natural gas is not in contact with significant quantities of crude oil in the reservoir; associated-dissolved natural gas occurs in crude oil reservoirs either as free gas (associated) or as gas in solution with crude oil (dissolved gas).

Natural gas reserves surged in 1980 and 1981, coinciding with an increase in wellhead prices, and a second surge occurred in the late-1990s, coinciding with new development of coalbed methane. The current increase in reserves is again the result of high prices recorded in the mid-2000s.

Utah Natural Gas Production (Gross) by County, 2012

Billion cubic feet (Percent of total)



Gross natural gas production is on the rise in Uintah County, which contains Utah's largest natural gas field, Natural Buttes, and in Duchesne County, where associated gas is produced along with increasing amounts of crude oil. Production is on the decline in all other counties, including Carbon and Emery Counties where production is mainly from coalbed methane resources.

UEMS website table: Table 4.5 | Source: DOGM

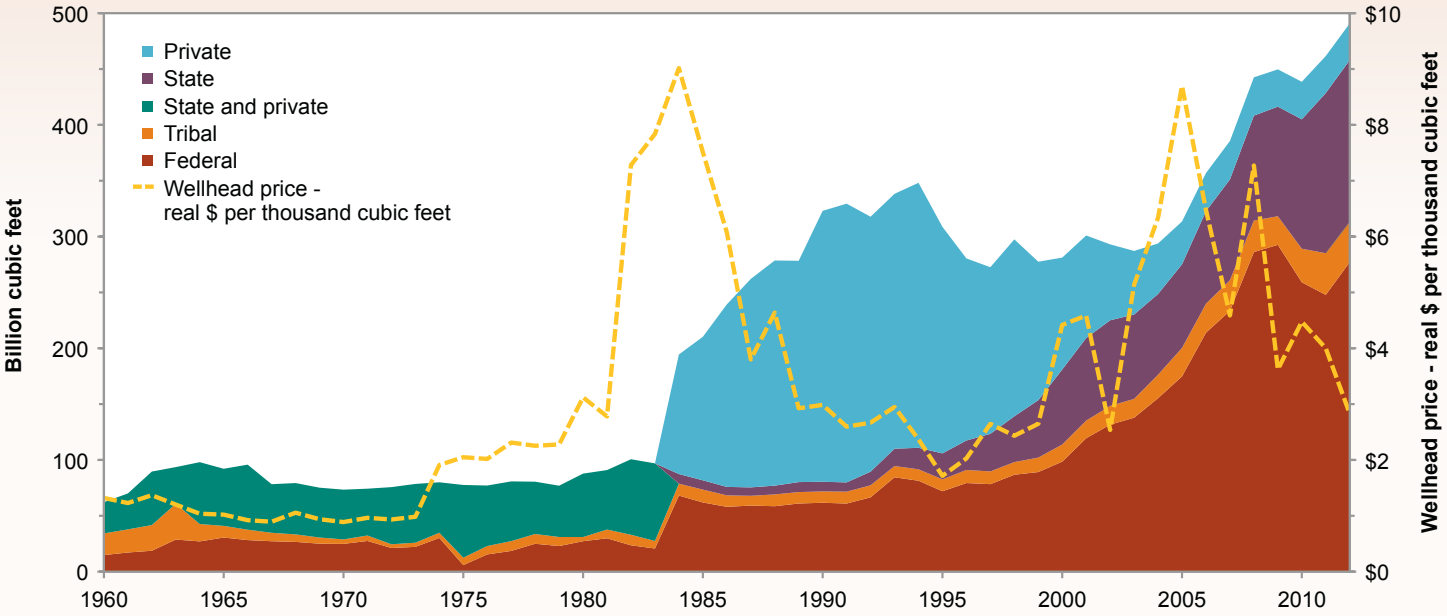
Note: "Other" includes Daggett and Garfield Counties.

The first major increase in natural gas production occurred in the mid-1980s, coinciding with a large spike in prices and the discovery of coalbed methane in central Utah (mostly on private land). The mid-2000s surge in production was also price related, with production increasing on federal land mostly in Uintah County.

2013 Update

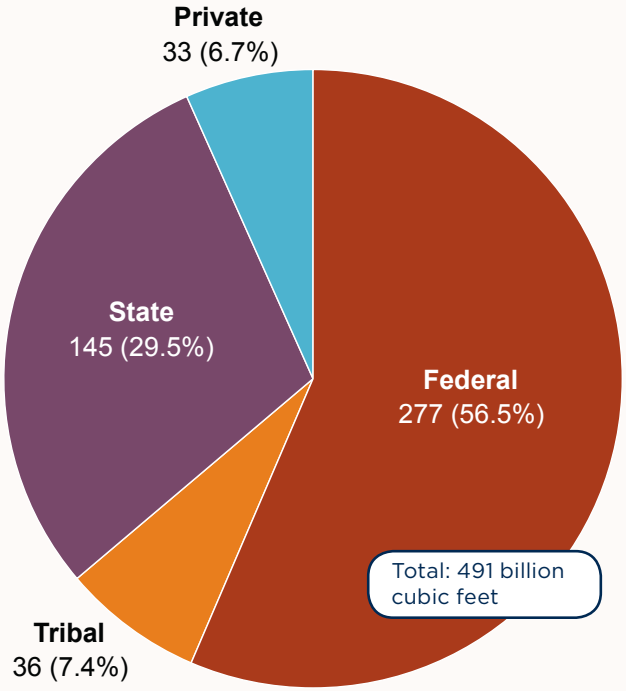
Natural gas production in Utah totaled approximately 470 billion cubic feet in 2013, with a downward to steady trend expected for the next few years.

Utah Natural Gas Production (Gross) by Landownership, 1960–2012



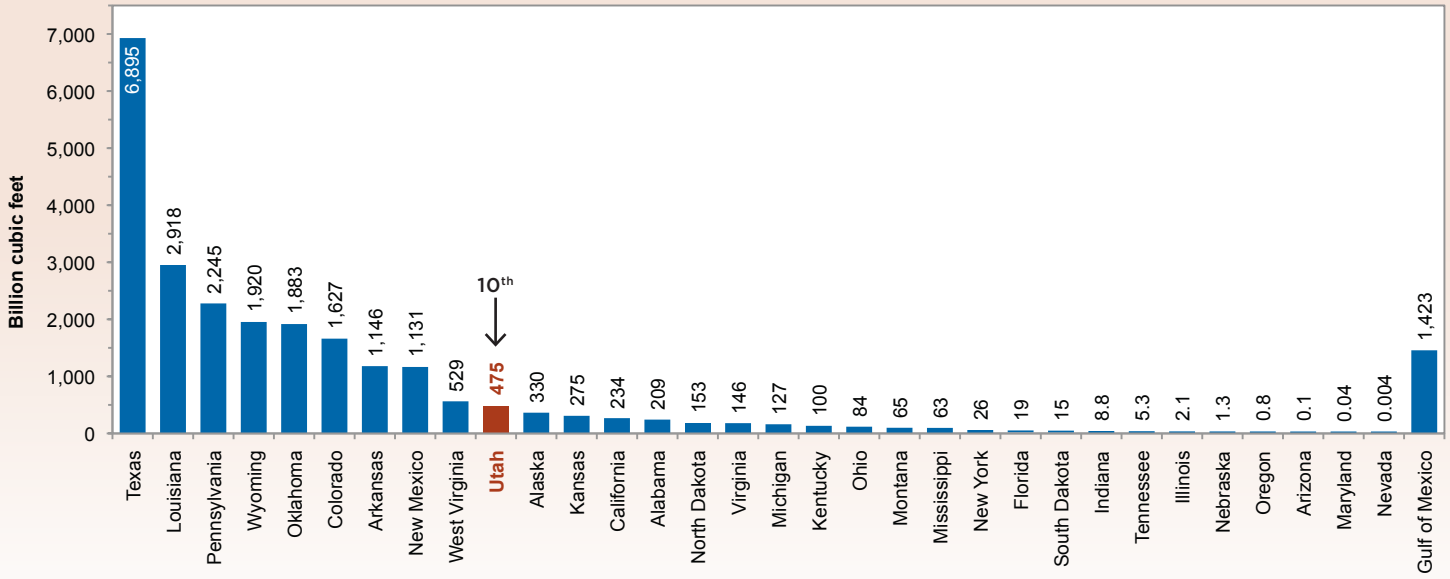
UEMS website table: Table 4.8 and Table 4.15
Source: DOGM, EIA

2012
Billion cubic feet (Percent of total)



Natural gas drilling in the Uinta Basin

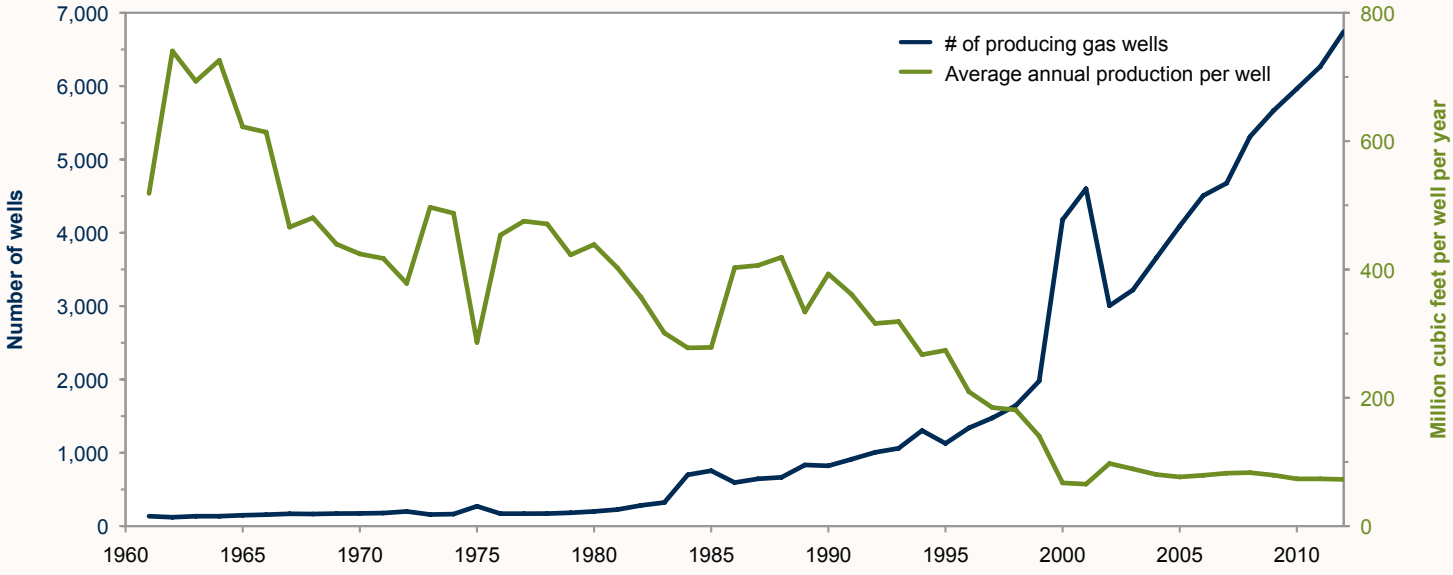
U.S. Natural Gas Production (Dry) by State, 2012



In 2012, Utah ranked as the 10th largest producer of natural gas in the United States (not including production in the Gulf of Mexico).

UEMS website table: Table 4.3 | Source: EIA, DOGM

Number of Producing Natural Gas Wells in Utah Versus Average Annual Production per Well, 1961–2012

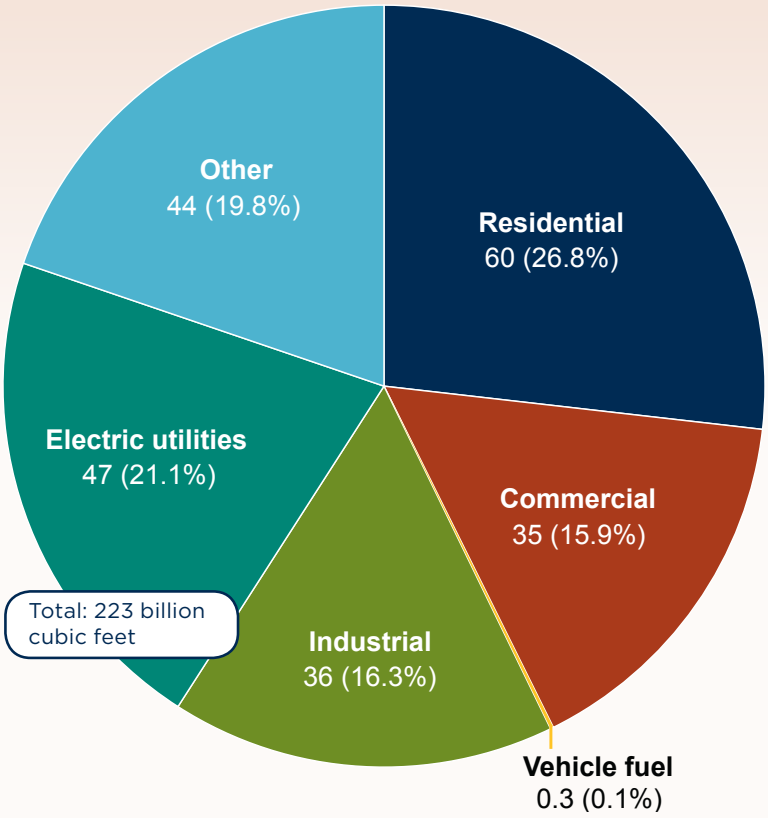


Similar to crude oil, as the total number of producing gas wells has increased over the years, the average annual production per well has decreased.

UEMS website table: Table 4.4 | Source: DOGM

Consumption of Natural Gas in Utah

2012
Billion cubic feet (Percent of total)

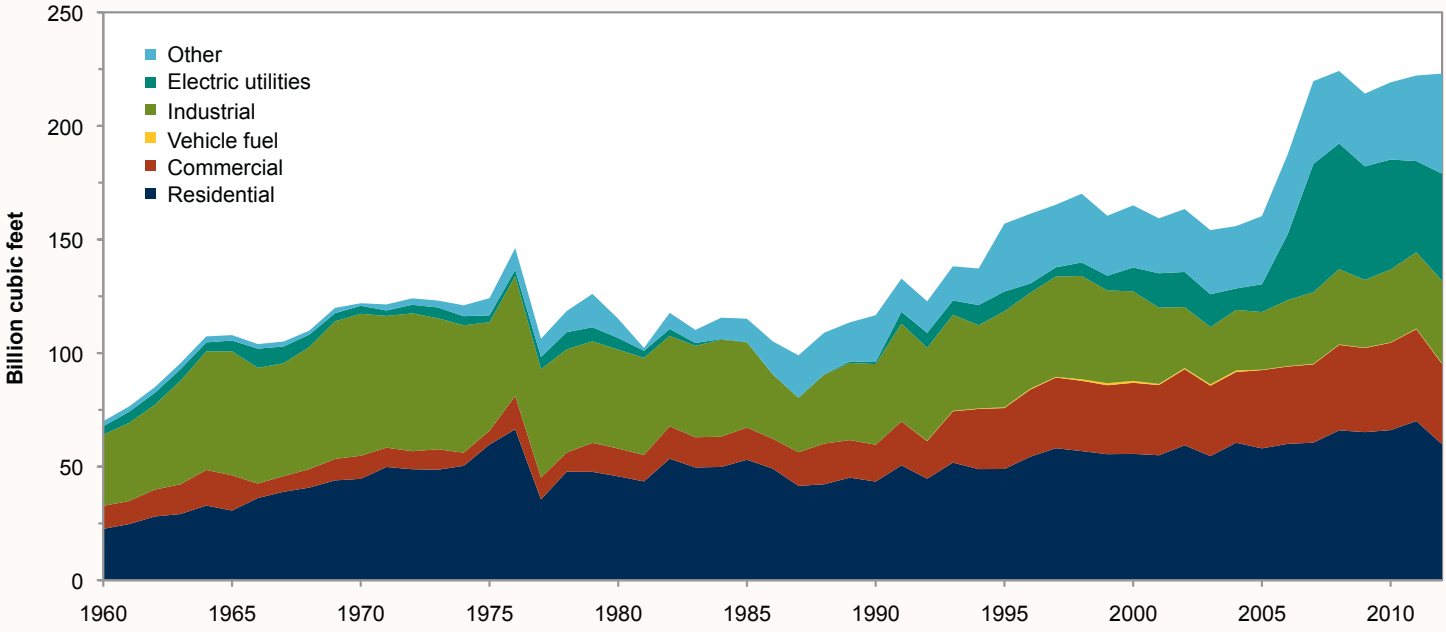


Natural gas wellhead at the Lisbon field, southeast Utah

Natural gas is mostly used for home heating (residential, 27%), but starting in mid-2004, 1300 MW of new natural-gas-fired electric generating capacity has come online, greatly increasing the amount used by the electric utility sector (from 8% in 2005 to 21% in 2012).

UEMS website table: Table 4.14 | Source: EIA
Note: "Other" includes lease use, plant use, and pipeline fuel.

1960–2012

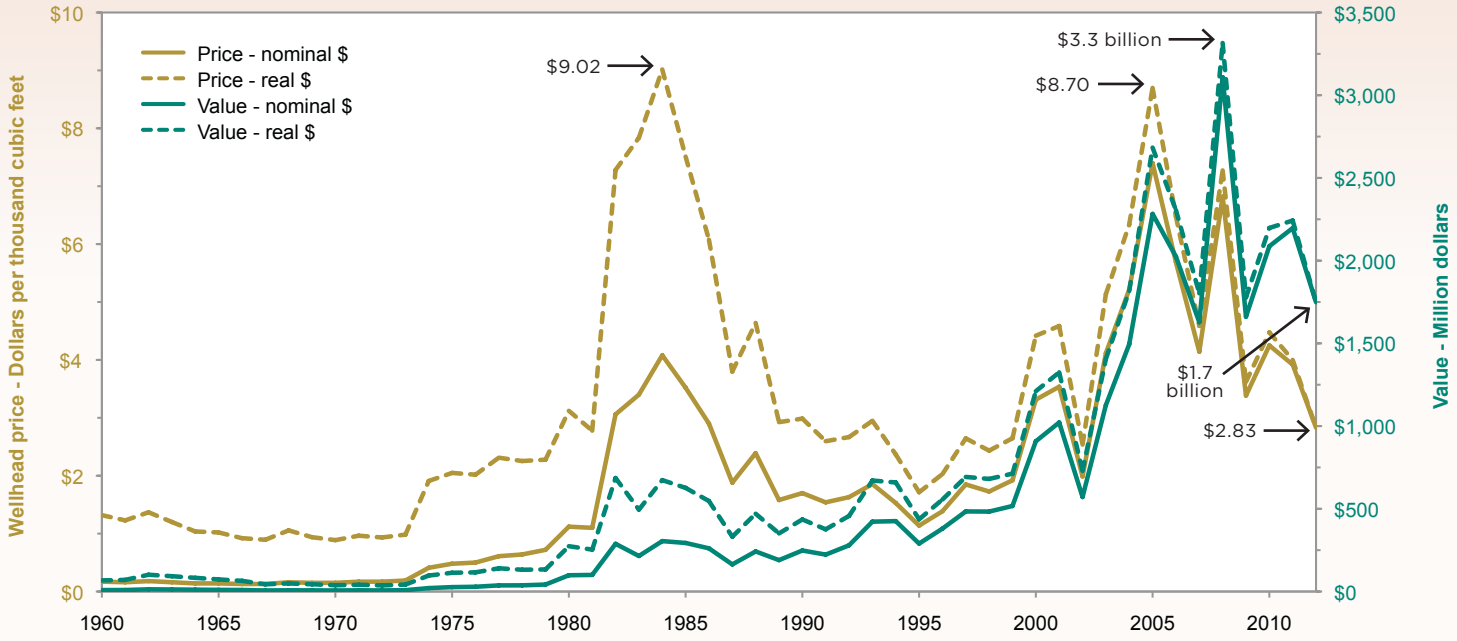


2013 Update

Utah's natural gas wellhead price averaged $3.70 per thousand cubic feet in 2013.

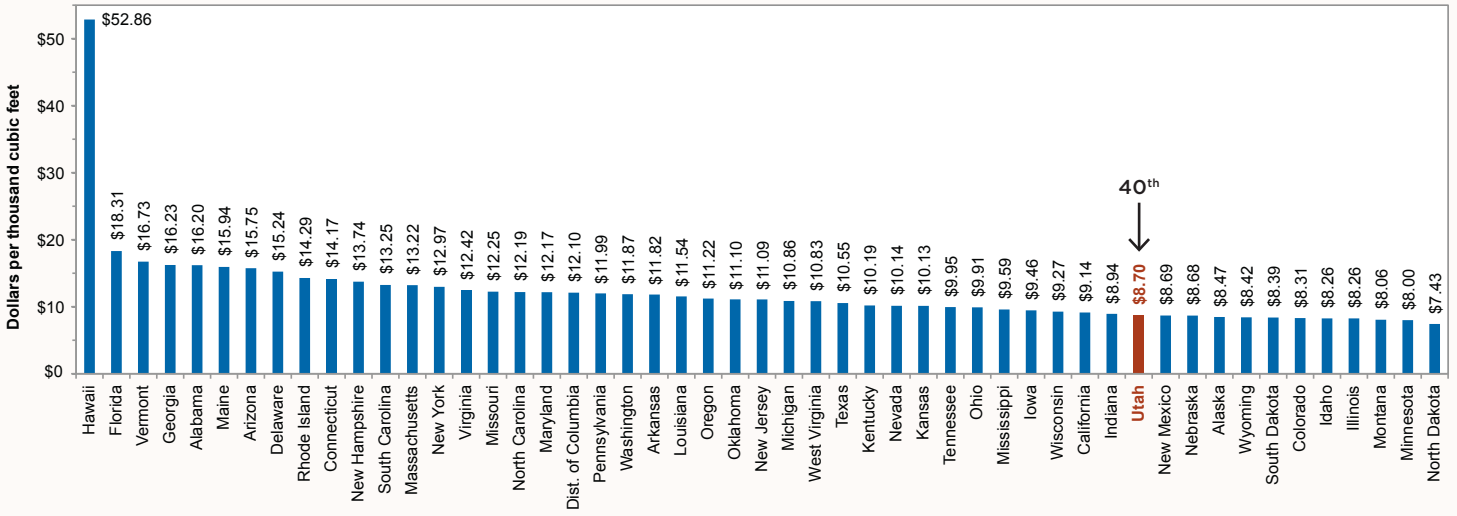
The price and value of natural gas produced in Utah in the past few years have fluctuated dramatically, peaking in 2005 (due to high prices related to Hurricane Katrina) and again in 2008, before settling down to $2.83 per thousand cubic feet in 2012, translating to a value of $1.7 billion.

Average Wellhead Price and Value of Natural Gas in Utah, 1960–2012



UEMS website table: Table 4.15 | Source: EIA

Average Price of Residential Natural Gas by State, 2012



In 2012, Utah had the 12th lowest price for residential natural gas in the country.

UEMS website table: Table 4.17 | Source: EIA

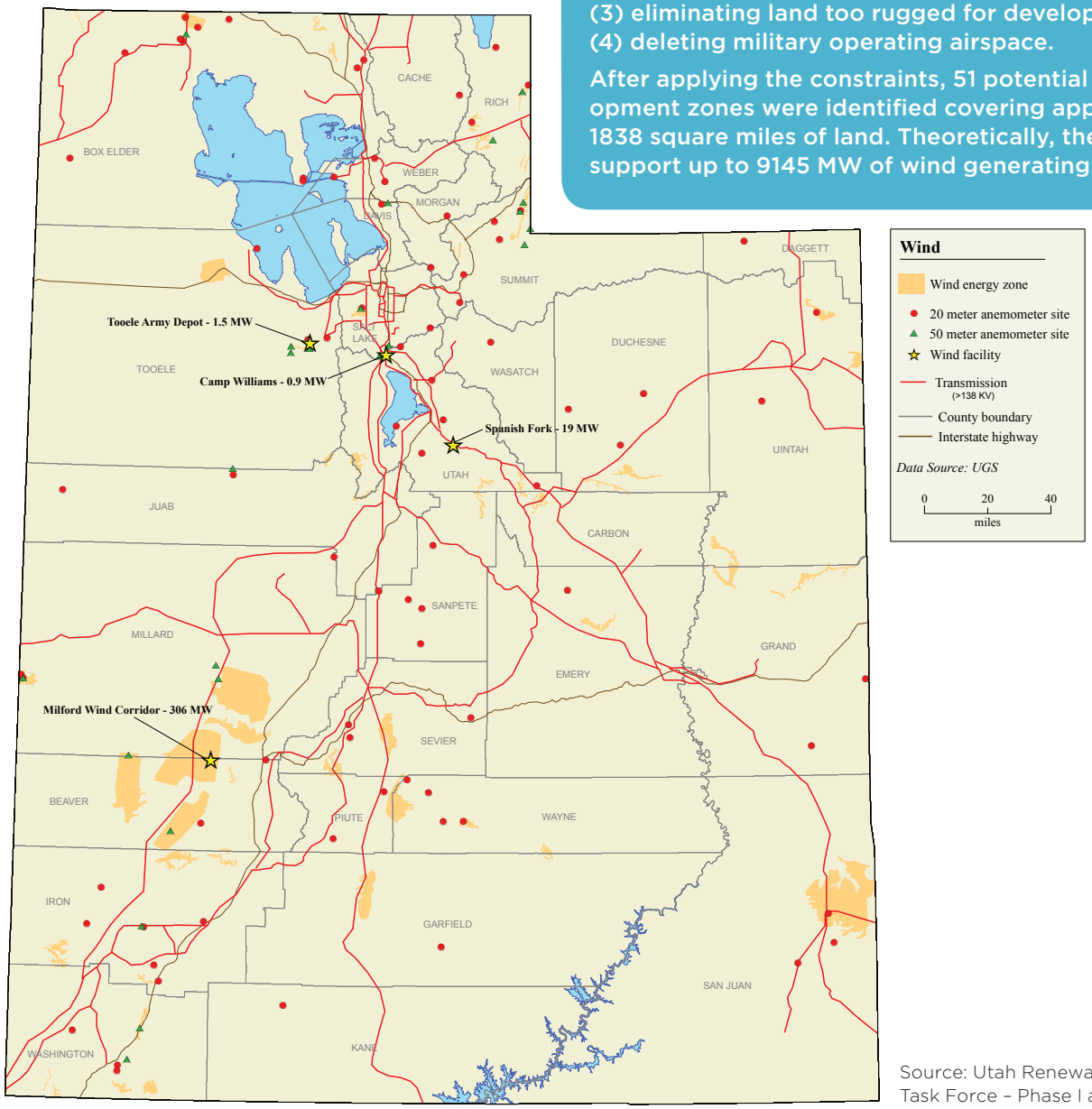
renewable resources

wind

Utah's extreme diversity in landscape and climate is well known, and this factor significantly affects Utah's wind resources. As a result, Utah has a wide array of locations that may be viable for wind energy development. The resource analysis used to identify favorable wind energy zones was based upon wind data collected from 109 anemometer towers stationed throughout the state. The wind resource analysis incorporated several constraining criteria, including:

(1) screening out environmentally sensitive areas,
(2) setting a maximum elevation of 9500 feet,
(3) eliminating land too rugged for development, and
(4) deleting military operating airspace.

After applying the constraints, 51 potential wind development zones were identified covering approximately 1838 square miles of land. Theoretically, these areas could support up to 9145 MW of wind generating capacity.



Source: Utah Renewable Energy Zones Task Force – Phase I and II

Solar

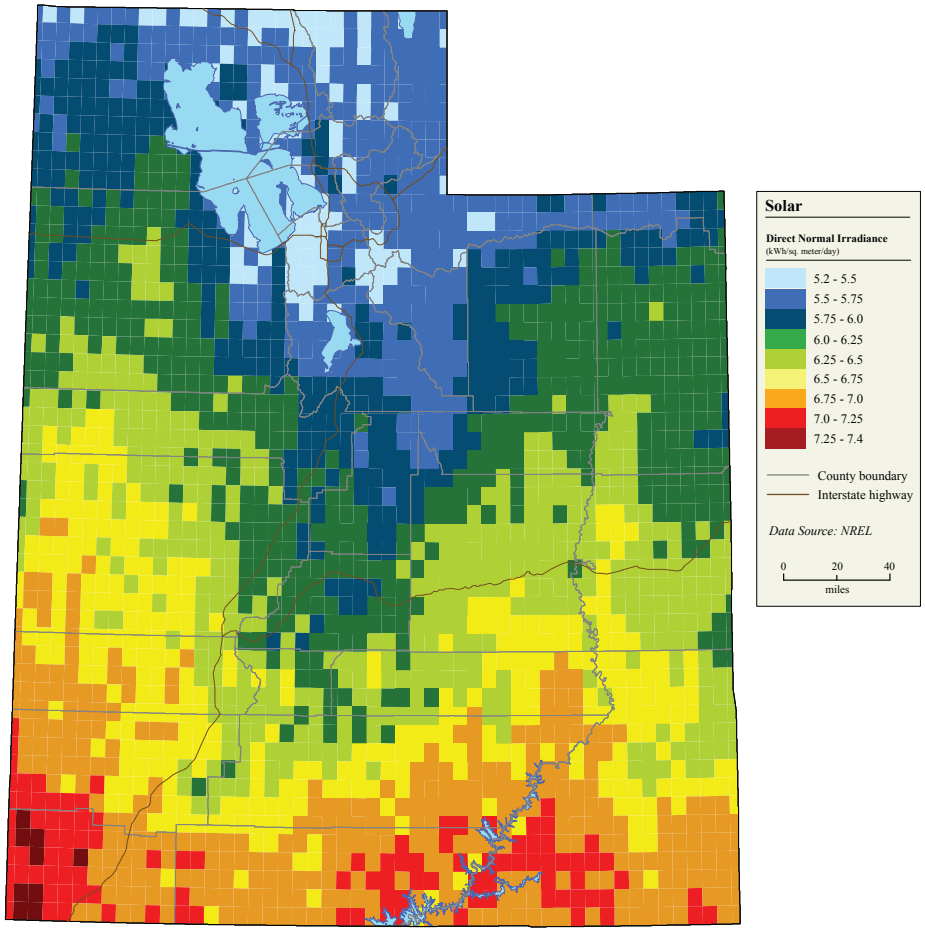
Utah's solar resources are clearly abundant (map at upper right, no screening applied), but to estimate a theoretical solar resource potential, several constraining criteria were used, including:

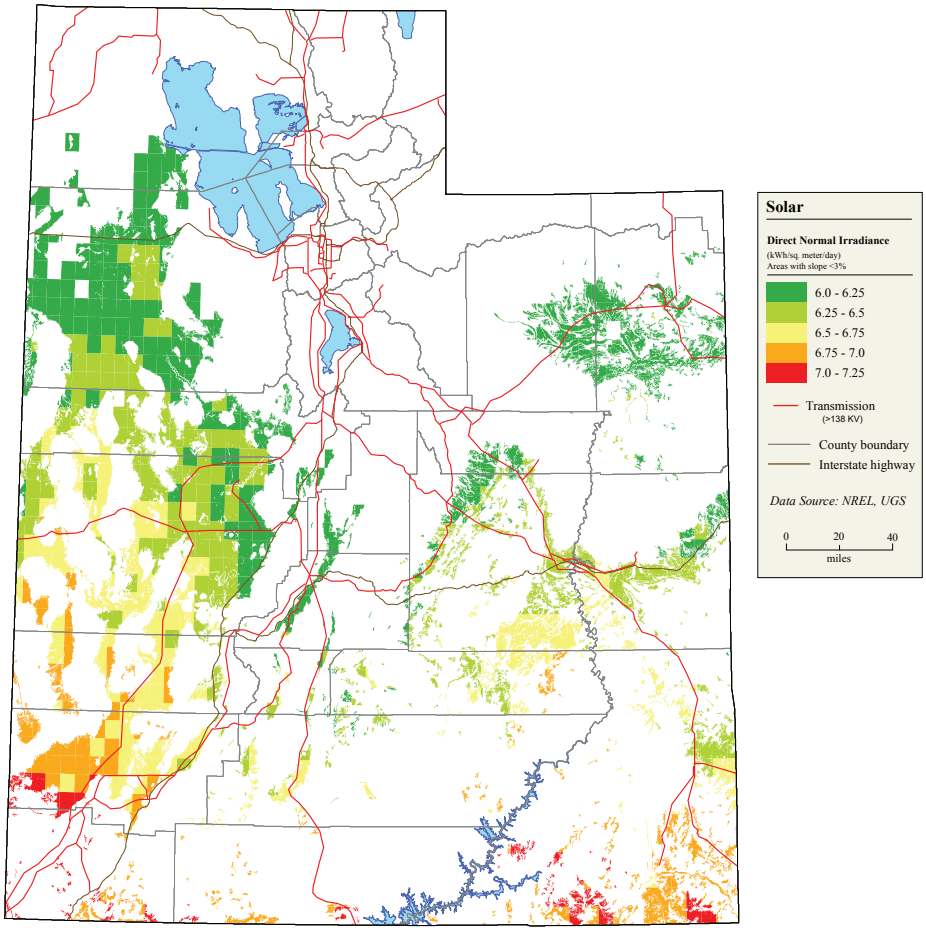
(1) measurements of Direct Normal Irradiance (DNI), with a threshold value of 6.0 kilowatthours per meter squared (kWh/m²)/ day or greater,

(2) screening out steeper areas (slopes of 3% or greater) unable to accommodate a large solar collection field, and

(3) screening out environmentally sensitive areas such as national parks, wilderness areas, wetlands, etc., that are not available for development.

After applying the constraints, approximately 6371 square miles of land are suitable for solar power generation at the utility scale (at lower right). Theoretically, this land could support up to 826 GW of solar generating capacity.

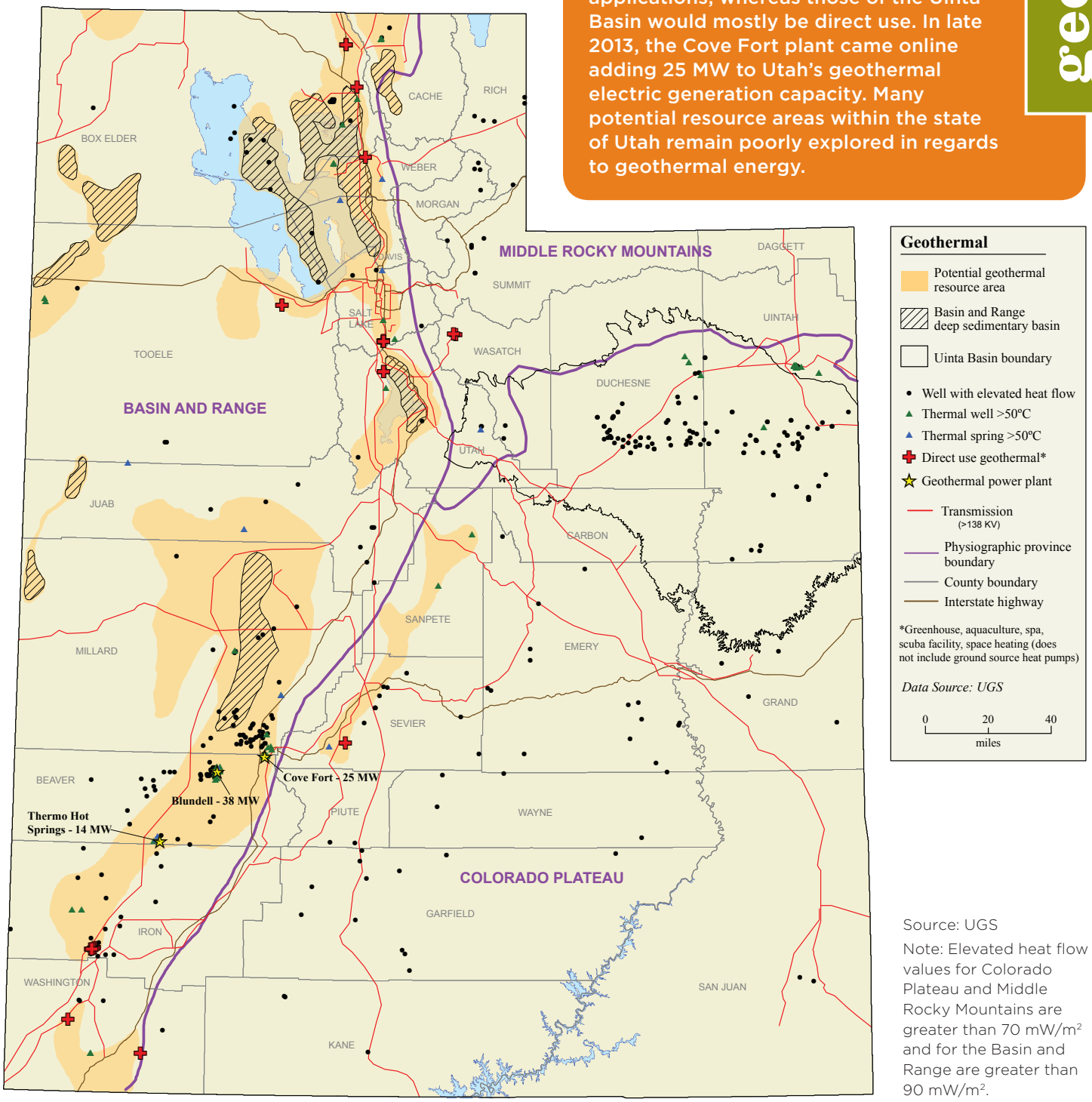




Source: Utah Renewable Energy Zones Task Force – Phase I and II

geothermal

The geothermal energy resource potential of Utah has been evaluated on the basis of information extracted from various types of thermal data throughout the state. Heat-flow data, thermal spring and well temperatures, and fluid chemistries are typically used as a first step in the screening for geothermal resources. Recent studies indicate deep (>10,000 ft) sedimentary basins within the Basin and Range physiographic province of western Utah may have significant geothermal potential. The Uinta Basin also has a potential geothermal resource due primarily to the existence of well infrastructure from the oil and gas industry combined with favorable data on co-produced fluid temperatures and production rates. Utah is home to a variety of geothermal resource utilization for both direct applications (greenhouses, spas, space heating, aquaculture) as well as electric power generation. Potential geothermal resources of the Basin and Range would likely include both types of geothermal applications, whereas those of the Uinta Basin would mostly be direct use. In late 2013, the Cove Fort plant came online adding 25 MW to Utah's geothermal electric generation capacity. Many potential resource areas within the state of Utah remain poorly explored in regards to geothermal energy.



Source: UGS

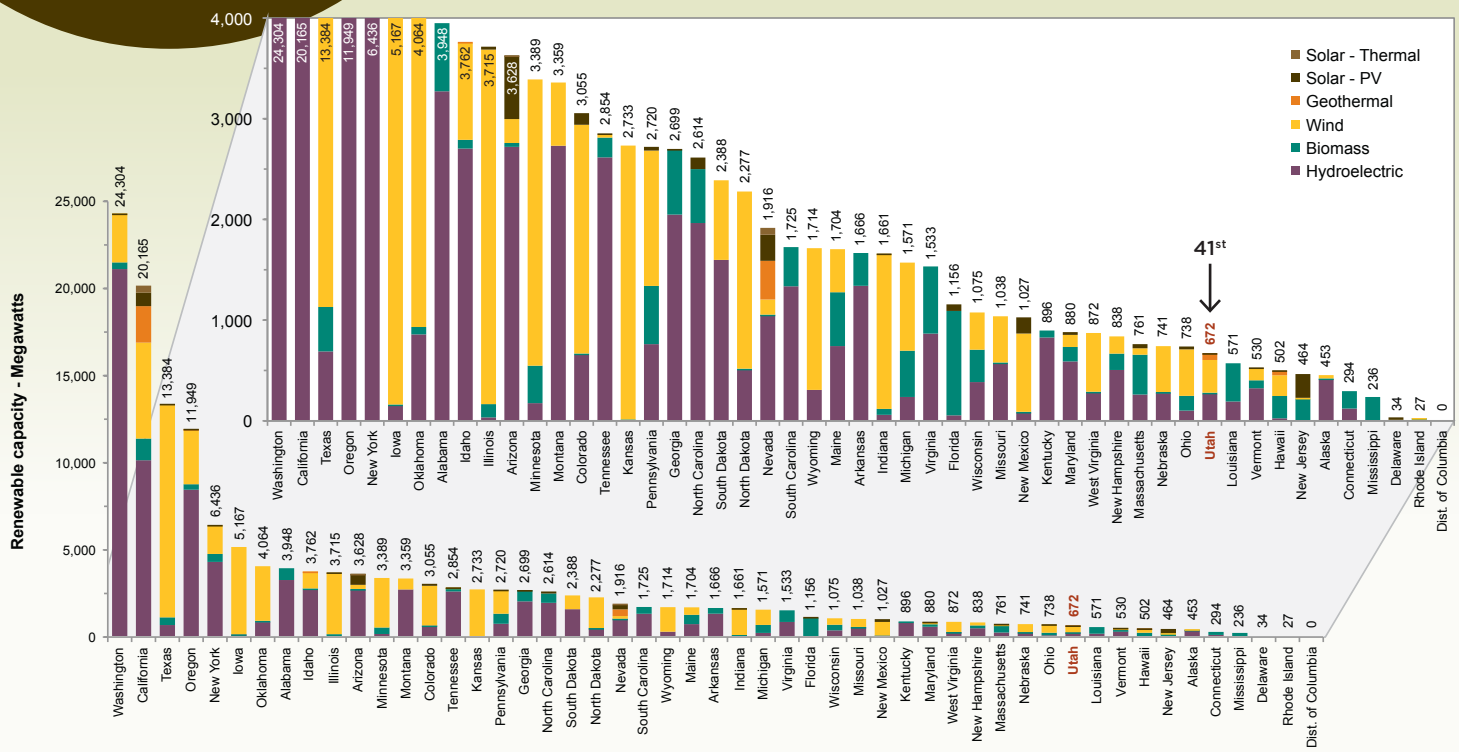
Note: Elevated heat flow values for Colorado Plateau and Middle Rocky Mountains are greater than 70 mW/m^2 and for the Basin and Range are greater than 90 mW/m^2.

2013 Update

Installed solar capacity in Utah is growing at very high rates, doubling in 2013 to about 22 MW.

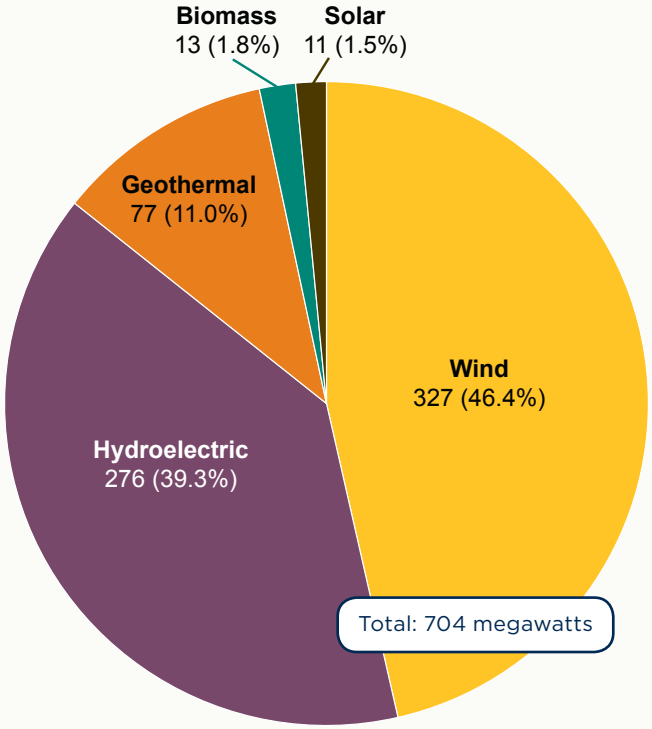
In 2012, Utah ranked 41st in the nation in total renewable net summer electric capacity.

Renewable Net Summer Capacity by Energy Source and State, 2012



Utah's Total (All Sectors) Renewable Nameplate Capacity by Energy Source, 2012

Megawatts (Percent of total)

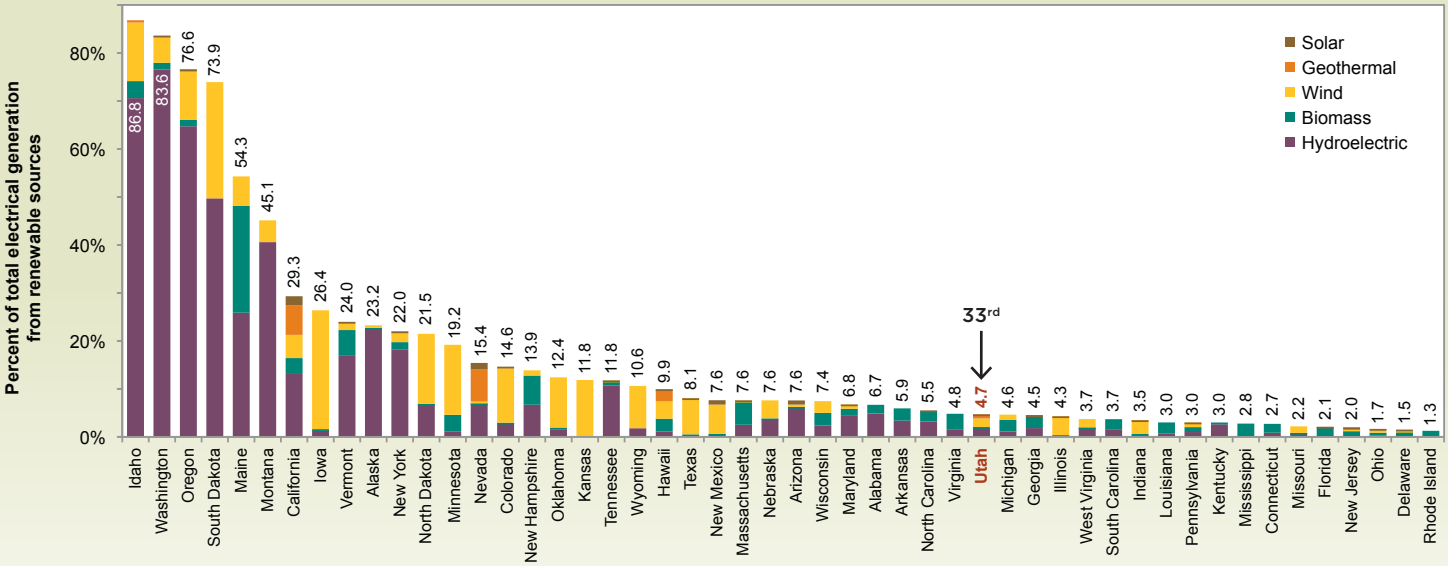


UEMS website table: Table 6.1 | Source: EIA, UGS

Note: Only includes utility scale capacity.

Utah's renewable electric capacity is dominated by 63 hydroelectric plants (the largest being Flaming Gorge at 152 MW) and two wind farms, Milford (306 MW) and Spanish Fork (19 MW). The geothermal portion consists of the Thermo Hot Springs plant (14 MW), PacifiCorp's Blundell plant (38 MW), and the new Cove Fort plant (25 MW), whereas the biomass portion is mainly from Wasatch Front landfill gas operations. Utah has a combined 11 MW of installed solar capacity, including numerous small commercial and residential arrays. Currently only three solar facilities are over 1 MW; the Salt Palace Convention Center in downtown Salt Lake City, IKEA in Draper, and a new concentrating solar plant at the Tooele Army Depot.

Renewable Electric Generation by State, 2012



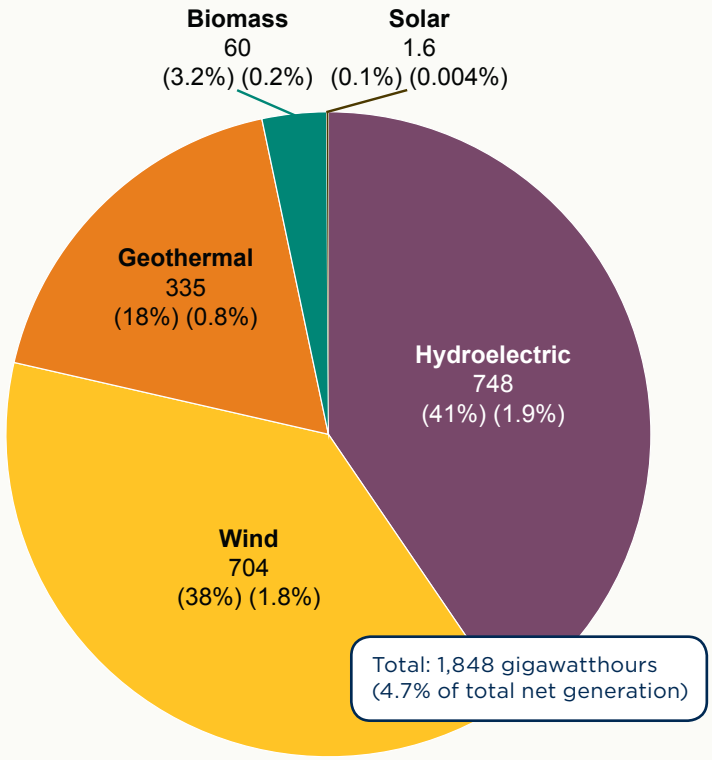
In 2012, Utah ranked 33rd in the nation in percent of total net electric generation from renewable resources. Of particular note, Utah is one of only six states where electricity is generated from geothermal resources (In early 2014, New Mexico became the 7th state to produce electricity from geothermal resources).

UEMS website table: Table 6.2 | Source: EIA

Renewable Electric Generation in Utah, 2012

Gigawatthours

(Percent of total renewables) (Percent total net generation)

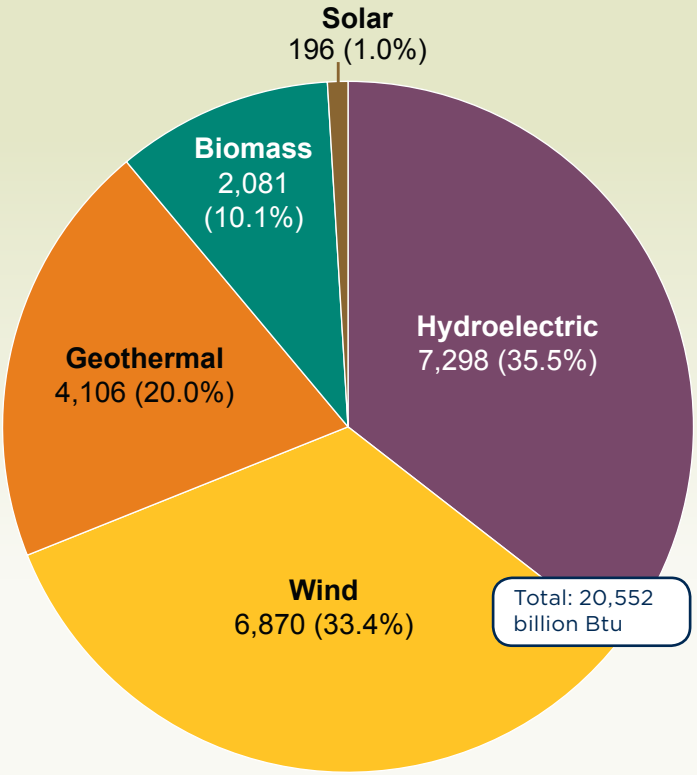


Cove Fort geothermal power plant

Utah's renewable electric generation is dominated by hydroelectric, wind, and geothermal power. The biomass portion is mainly electricity generated from burning landfill gases.

Renewable Energy Consumption in Utah

2012
Billion Btu (Percent of total)



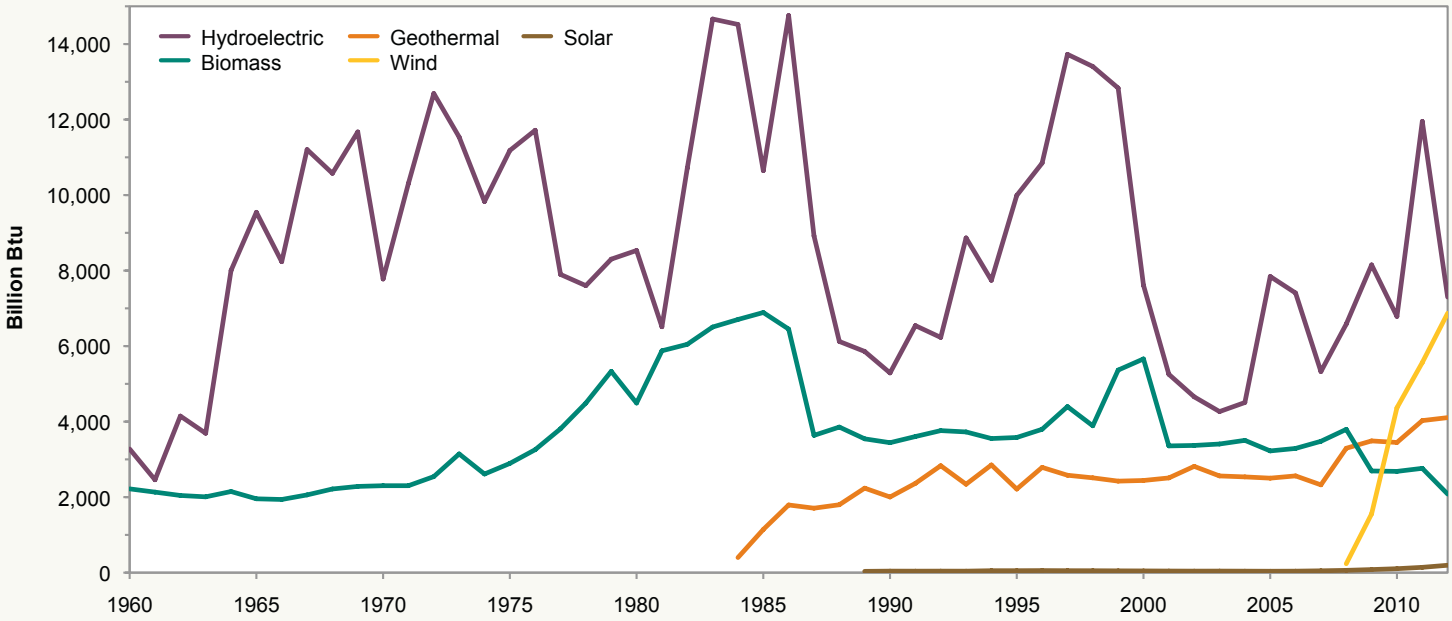
UEMS website table: Table 6.3 | Source: EIA

Note: EIA assumes that all renewable electric generation originating in Utah is also consumed in Utah, but this is not always the case (e.g., electricity from the Milford wind farm is sold to California); 2012 data is estimated; includes the electric utility sector.

Utah's 2012 consumption of energy from renewable resources is dominated by hydroelectric power generation (following trends of high precipitation), followed by wind, geothermal, and biomass. The small amounts of solar power generation came from commercial- and residential-scale photovoltaic arrays.

Spanish Fork wind farm

1960–2012



unconventional petroleum resources

oil shale

In 2008, the Utah Geological Survey completed a comprehensive oil shale resource assessment for deposits in the state of Utah. Not to be confused with the headline-dominating "shale oil," which is oil produced via horizontal wells and hydraulic fracturing (e.g., the Bakken shale in North Dakota), oil shale must be heated to high temperatures to convert the organic matter (kerogen) into usable oil. The UGS oil shale assessment answers the questions of "where" and "how much" that many people ask regarding Utah's largest unconventional resource by providing detailed basin-wide resource maps and estimates of potential in-place oil.

- A continuous interval of oil shale that averages **50 gallons of oil per ton of rock (GPT)** contains an in-place resource of **31 billion barrels** of oil.
- A continuous interval of oil shale that averages **35 GPT** contains an in-place resource of **76 billion barrels** of oil.
- A continuous interval of oil shale that averages **25 GPT** contains an in-place resource of **147 billion barrels** of oil (see included map).
- A continuous interval of oil shale that averages **15 GPT** contains an in-place resource of **292 billion barrels** of oil.

After calculating in-place resource numbers, the UGS imposed several constraints on the total endowment to offer a more realistic impression of Utah's potentially economic oil shale resource. The constraints used were:

- deposits having a richness of at least 25 GPT (assumed minimum grade),
- deposits that are at least 5 feet thick (assumed minimum mining thickness),
- deposits under less than 3000 feet of cover (maximum underground mining depth),
- deposits that are not in direct conflict with current conventional oil and gas operations, and
- deposits located only on U.S. Bureau of Land Management, state trust, private, and tribal lands.

Accounting for these constraints, UGS estimates that the potential economic oil shale resource in Utah is approximately **77 billion barrels**.

Currently, only a handful of companies are pursuing oil shale development in Utah, all focusing on near surface deposits in the southeastern part of the resource.

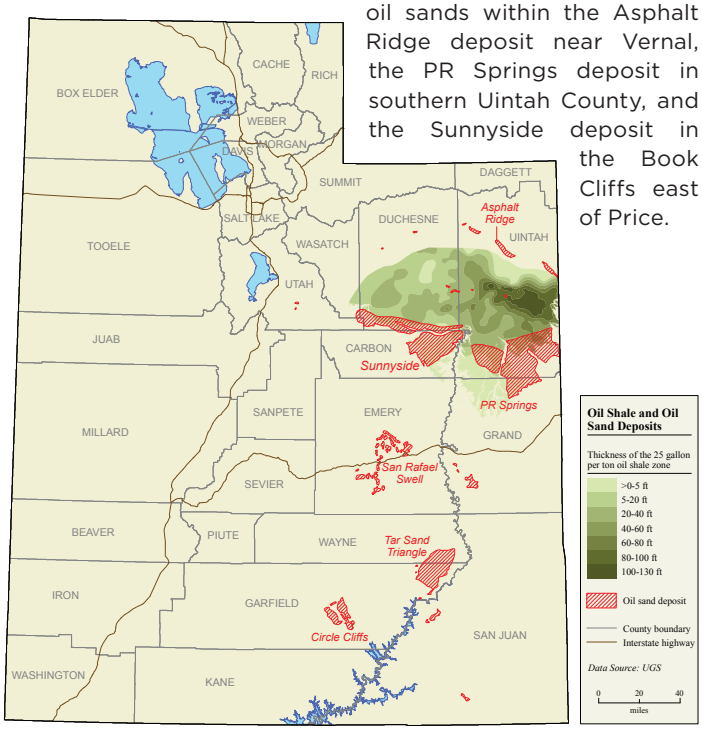
The most prospective unconventional fossil fuel resources are located in the Uinta Basin in northeastern Utah.

oil sands

North America has the greatest oil sand resources in the world, the majority of which are in Canada. Utah's oil sand resource, though small in comparison to that of Canada, is the largest in the United States. Utah's oil sand deposits contain 14 to 15 billion barrels of measured in-place oil, with an additional estimated resource of 23 to 28 billion barrels. Twenty-four individual deposits exist in the Uinta Basin, mainly around its periphery, and an additional 50 deposits are scattered throughout the southeastern part of the state. Utah's major oil sand deposits individually have areal extents ranging from 20 to over 250 square miles, as many as 13 pay zones, gross thickness ranging from 10 to more than 1000 feet, and overburden thickness ranging from zero to over 500 feet.

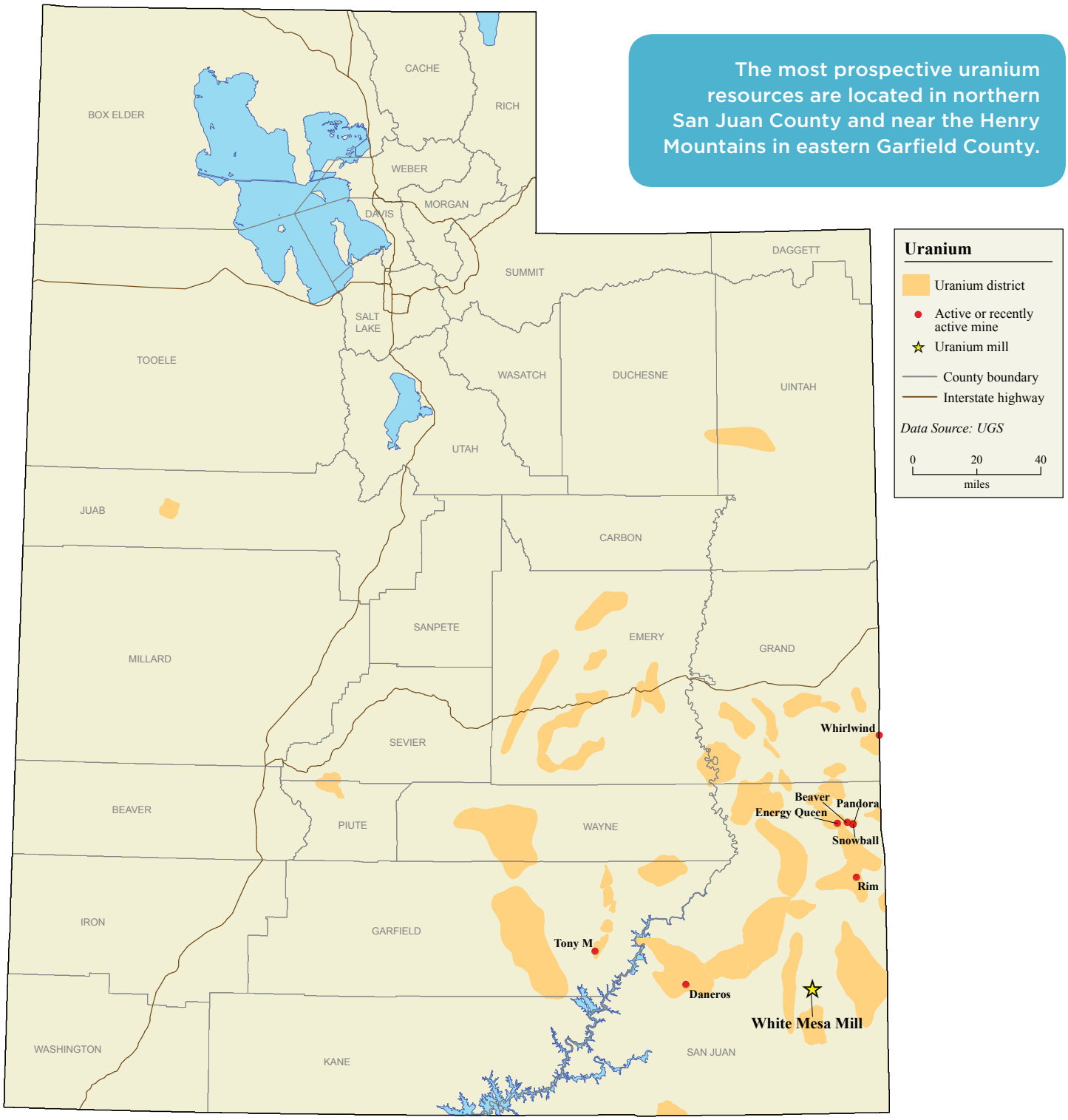
With the current high price of crude oil as an incentive, new drilling, bitumen extraction, and upgrading techniques developed in Canada may provide the necessary knowledge for successful and sustainable development of oil sand in Utah in the near future. However, factors such as site accessibility, adequate infrastructure, water availability, environmental concerns, land access and permitting, and the problems associated with the heterogeneity of reservoir sands must be resolved before economically viable oil sand development can become a reality in Utah.

Currently, several companies are researching development of oil sands within the Asphalt Ridge deposit near Vernal, the PR Springs deposit in southern Uintah County, and the Sunnyside deposit in the Book Cliffs east of Price.



uranium

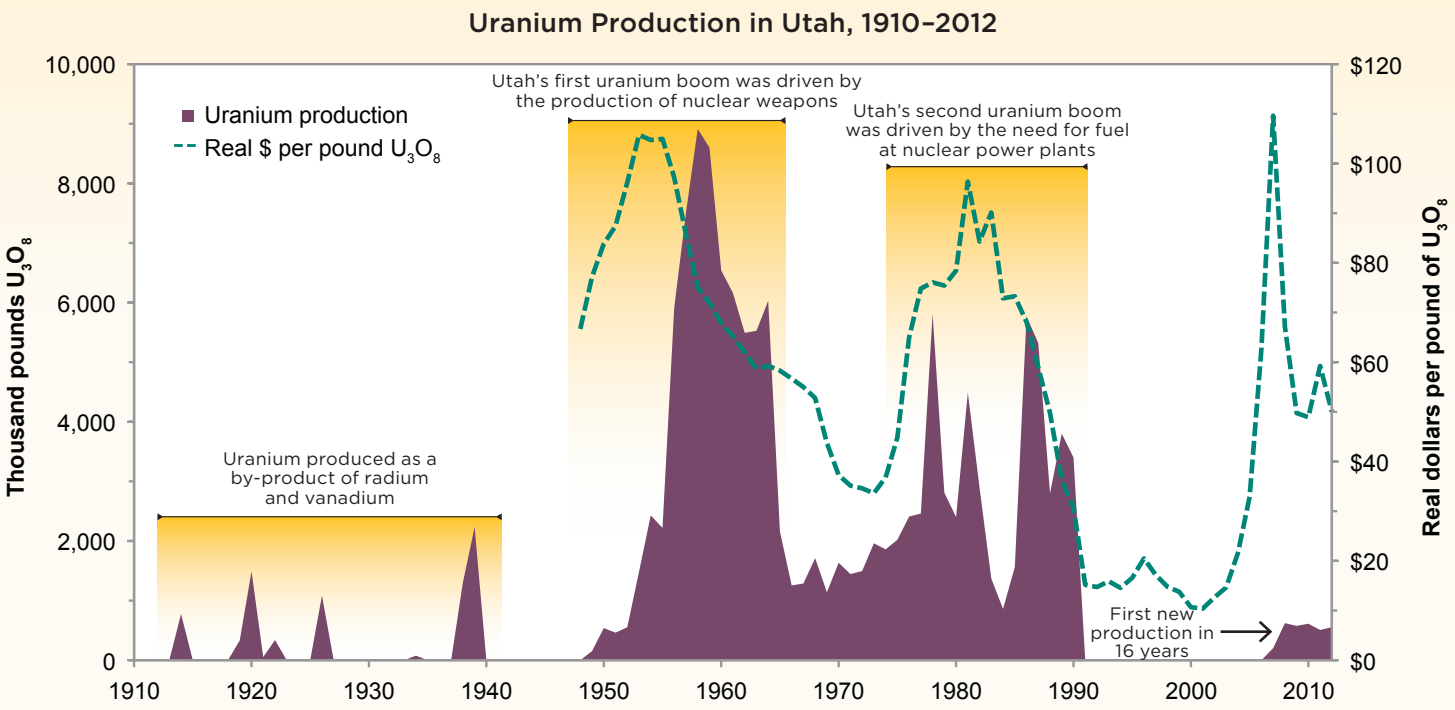
The most prospective uranium resources are located in northern San Juan County and near the Henry Mountains in eastern Garfield County.



From 1910 to 1940, uranium was produced as a byproduct of first radium, then vanadium. Utah's first big uranium boom started in 1948 when the U.S. Atomic Energy Commission set a guaranteed price and bonus schedule for domestic uranium ore, driven by the requirements of nuclear weapons production. Utah's uranium production grew rapidly during the late-1940s and 1950s, peaking in 1958 at 8.9 million pounds of U_3O_8 before declining in the mid-1960s. During this time, production occurred at over 500 individual mines.

2013 Update

Uranium production in Utah totaled 55 thousand pounds in 2013 and no production is currently expected in 2014 and beyond.



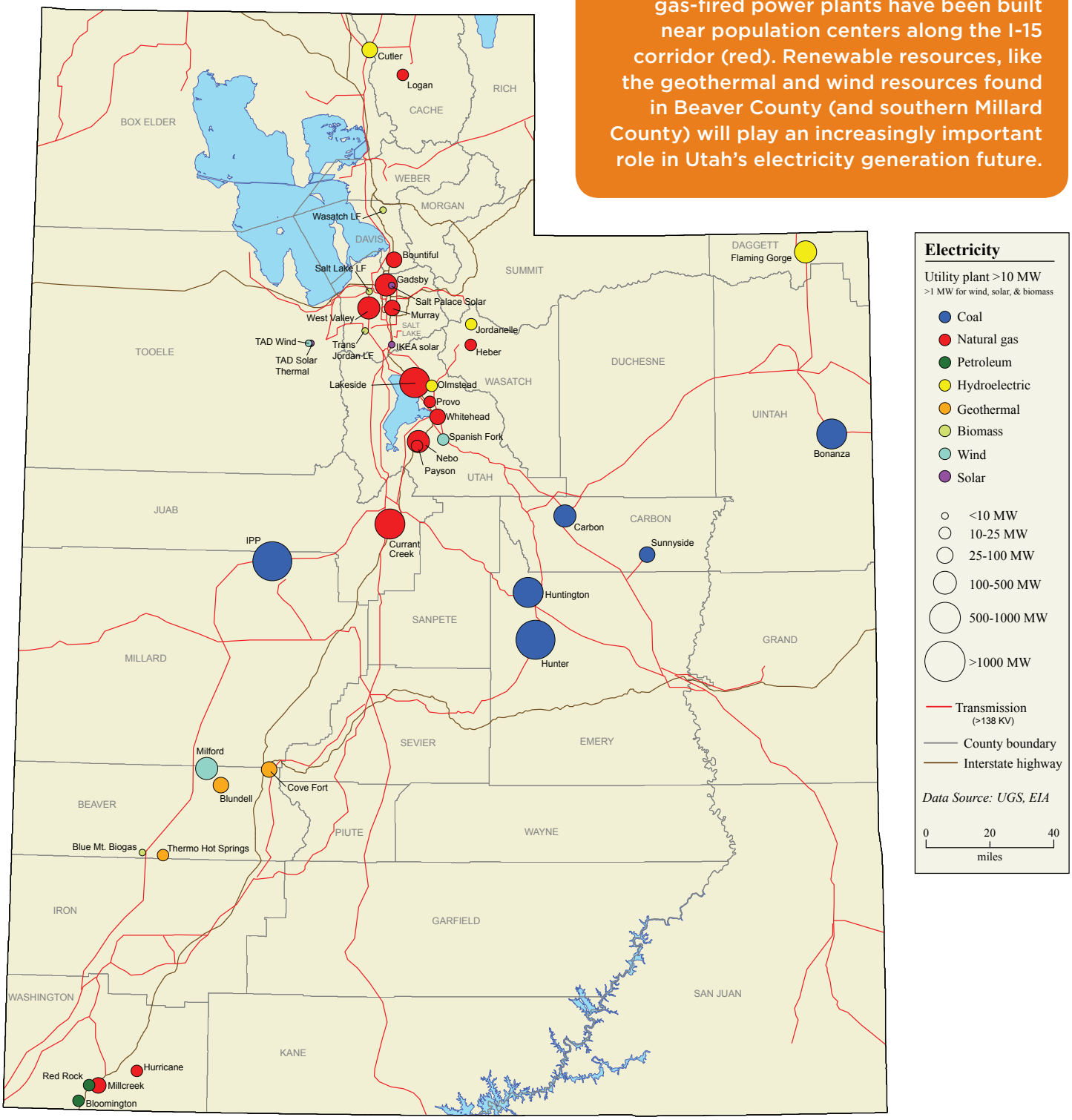
UEMS website table: Table 9.1 | Source: EIA, UGS

A second period of uranium production began in the early-1970s with the development of the nuclear power industry, peaking in 1978 at 5.8 million pounds U_3O_8. Since the mid-1980s, Utah's underground ores had difficulty competing with other lower cost operations, exacerbated by the discovery of very large, high-grade, near-surface uranium ore in Canada and Australia. By 1990, all of Utah's uranium production had ceased and within a few years there were no longer any underground uranium mines operating in the United States.

Beginning in 2004, the price of uranium began to rise, reaching an inflation-adjusted record high of $110 per pound in 2007. This resurgence in uranium price resulted in the reopening of several Utah uranium mines which produced 553,000 pounds in 2012. In addition, the White Mesa uranium mill, located outside of Blanding, Utah, once again began processing uranium ore. However, as prices dropped to around $40 per pound in 2013, uranium production in Utah has once again come to a stop.

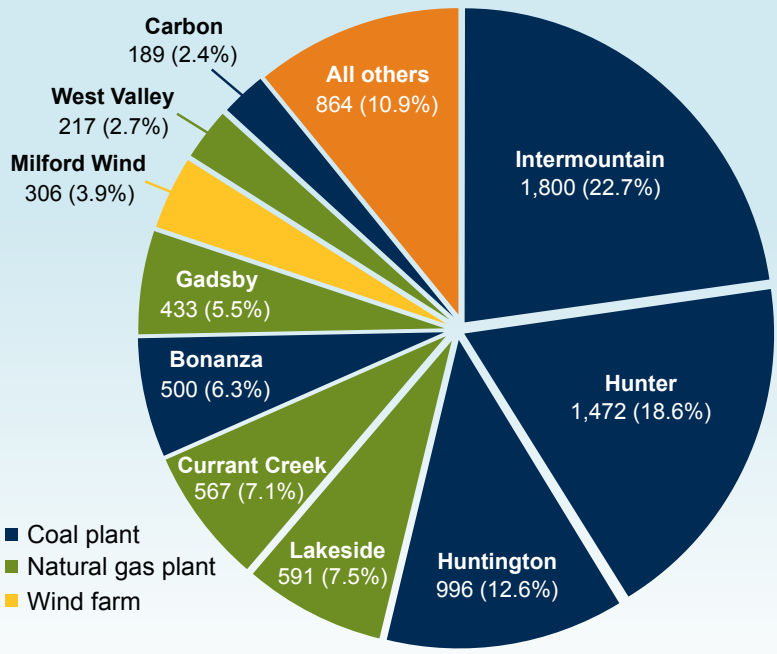
electricity

Utah's electric generation is dominated by six large coal-fired power plants (blue), but in recent years, many new natural-gas-fired power plants have been built near population centers along the I-15 corridor (red). Renewable resources, like the geothermal and wind resources found in Beaver County (and southern Millard County) will play an increasingly important role in Utah's electricity generation future.



Utah's 10 Largest Power Plants

Capacity in megawatts (Percent of total)



Utah's total electric capacity: 7,934 megawatts

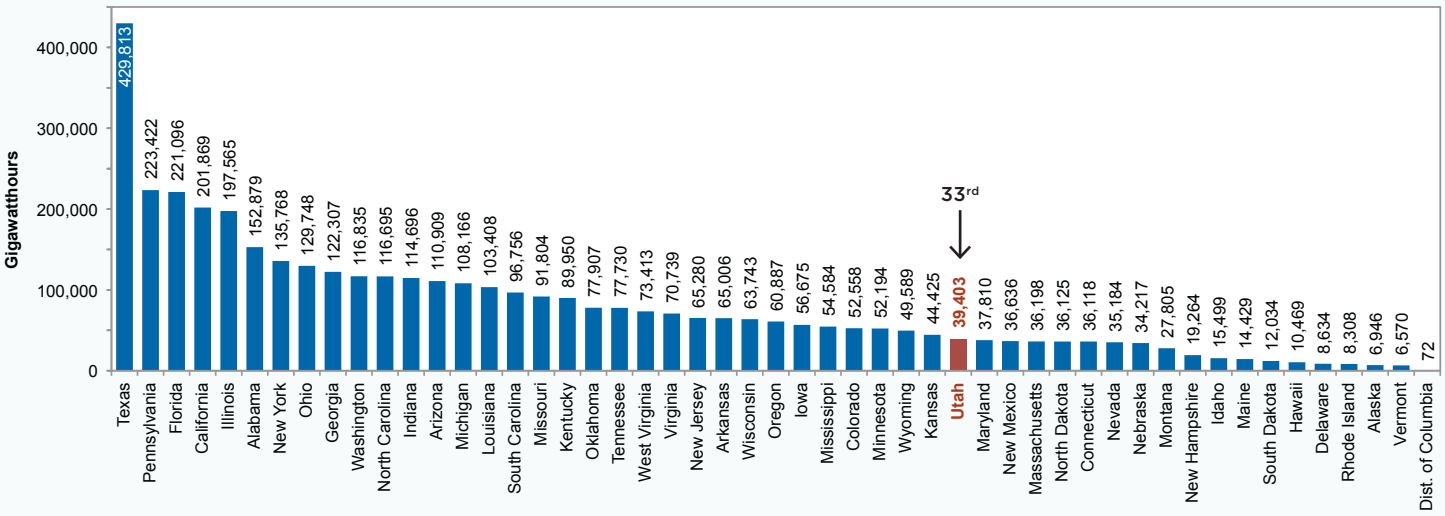
Fossil fuels: 7,242 MW (91.3%)
Renewables: 692 MW (8.7%)

UEMS website table: Table 5.1 | Source: EIA
Note: Only includes utility plants.

Utah's electricity portfolio is dominated by coal-fired power plants. However, several natural gas plants have been built in the past ten years (Lakeside – 2007, Currant Creek – 2005-2006, West Valley – 2002, and three new units at Gadsby – 2002) decreasing reliance on coal generation. Also, the recently constructed Milford wind farm has added 306 MW of renewable capacity to Utah's energy mix.

Intermountain coal-fired power plant

U.S. Electricity Generation by State, 2012



Utah's total net generation of electricity ranked 33rd in the nation in 2012.

UEMS website table: Table 5.9 | Source: EIA

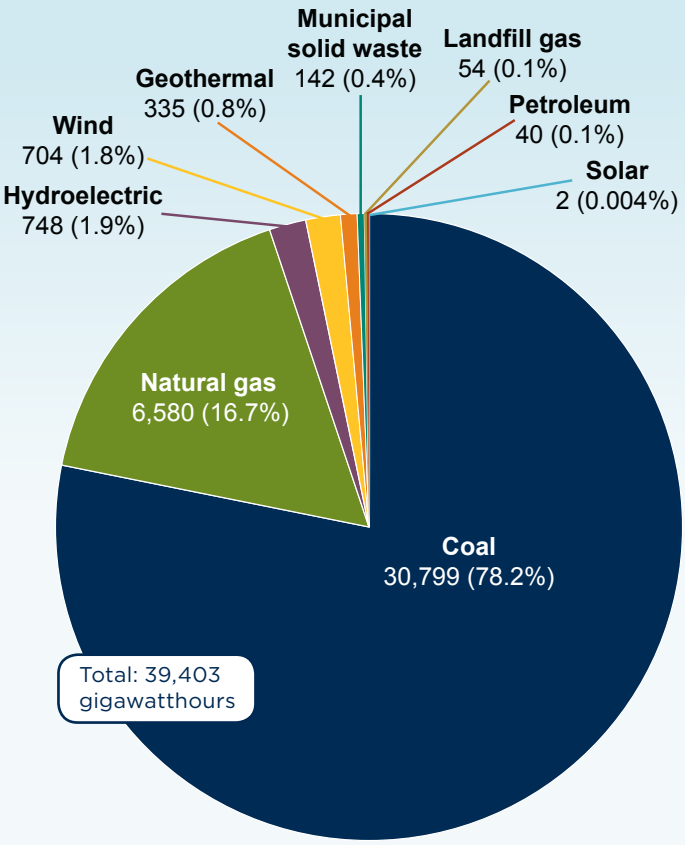
2013 Update

Electric generation in Utah is expected to rebound to 42,825 gigawatthours in 2013.

Net Generation of Electricity in Utah by Energy Source

Coal has dominated Utah's electricity generation portfolio, accounting for 94% of Utah's total net generation in 2005. However, since 2004, 1418 megawatts of new natural-gas-fired electric capacity were built, decreasing coal's overall share to 78% in 2012 and increasing natural gas's share to 17%. Utah's share of electricity generated from renewable resources has jumped to 4.7% with the recent addition of the 306-megawatt Milford wind farm. Electric generation declines between 2009 and 2011 were recession related. Net generation should have rebounded in 2012; however, one of two units at the Intermountain Power Plant experienced an unexpected 6-month maintenance shut-down, resulting in an estimated decline of electric generation of about 6% (or 2500 GWh).

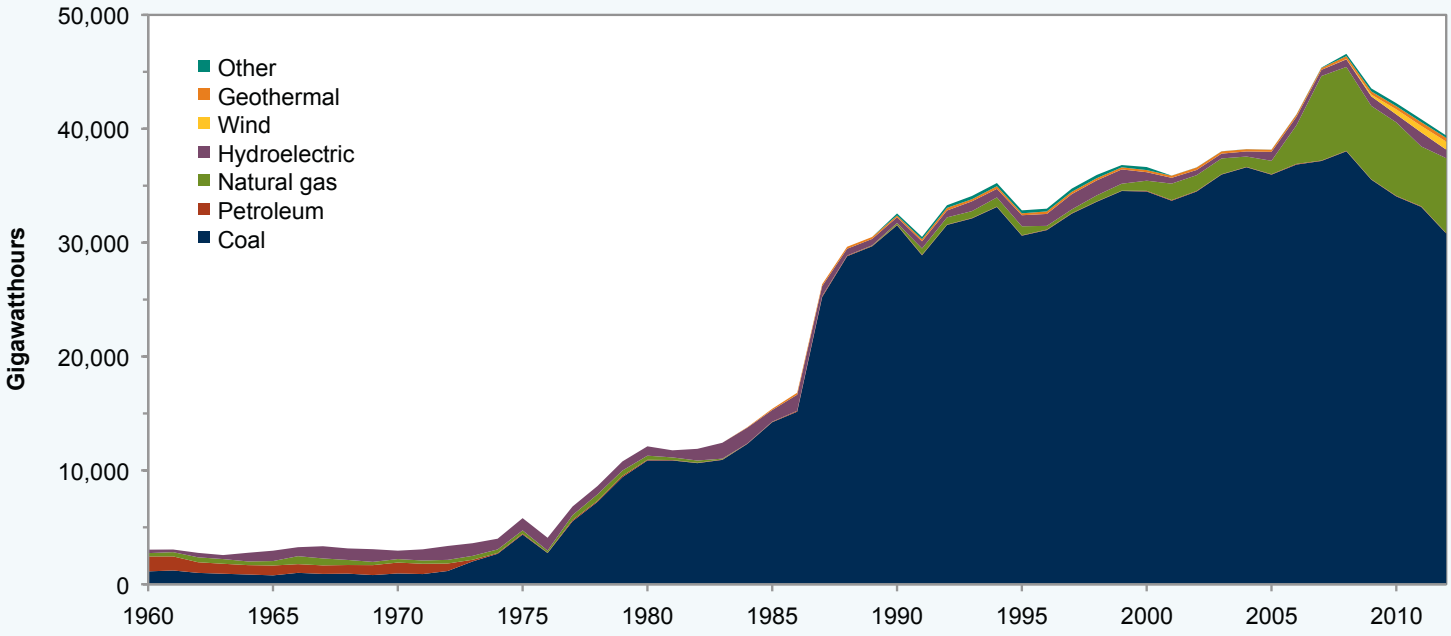
2012
Gigawatthours (Percent of total)



UEMS website table: Table 5.10 | Source: EIA

Note: "Other" includes municipal solid waste, landfill gas, solar, and other gases derived from fossil fuels.

1960–2012

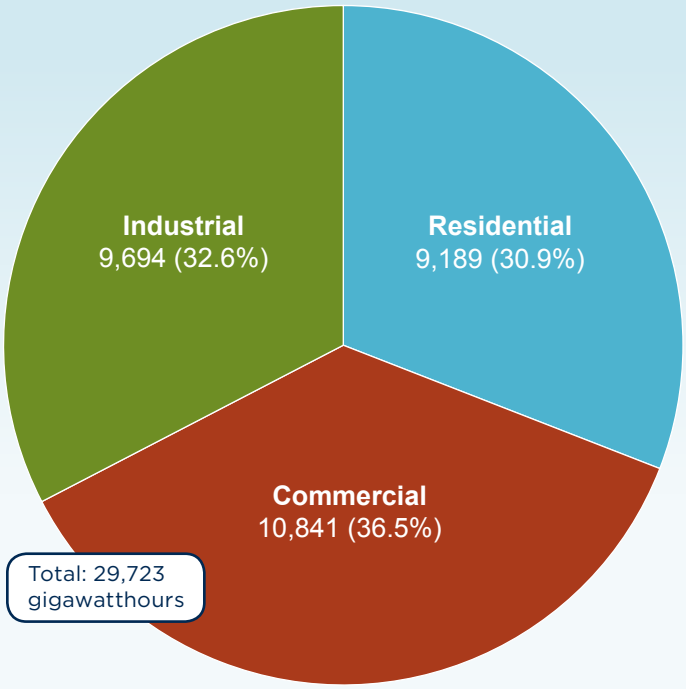


Sales of Electricity in Utah by Sector

2013 Update

Sales of electricity in Utah are expected to reach a record 30,334 gigawatthours in 2013.

2012
Gigawatthours (Percent of total)

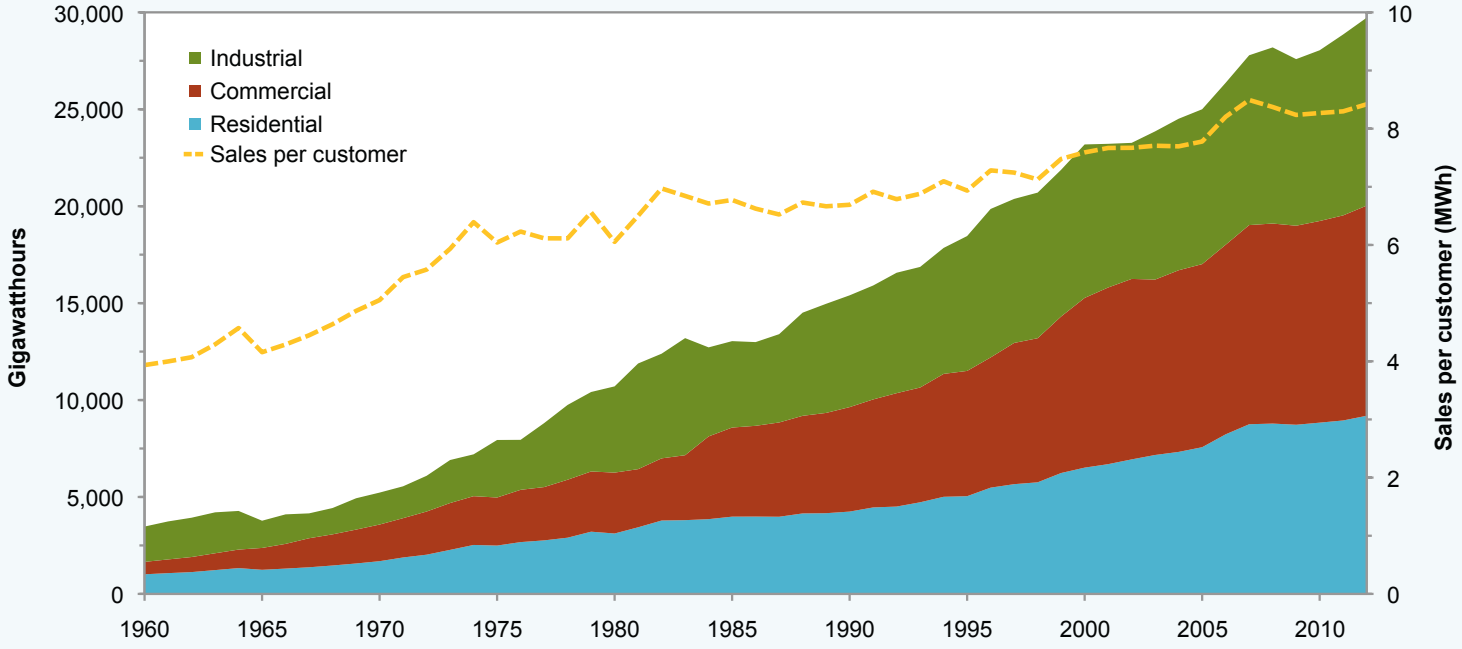


Since 1960, electricity sales in Utah increased at an average annual rate of 4.3%, roughly following increases in population (an average increase of 2.3% per year) and increases in per customer electricity use (an average increase of 1.5% per year). In 1960, each residential customer in Utah used about 13 MWh annually (all customers used about 4 MWh per year). Currently, the average residential customer usage has more than doubled to 27 MWh per year (or a little over 8 MWh per year for all customers).

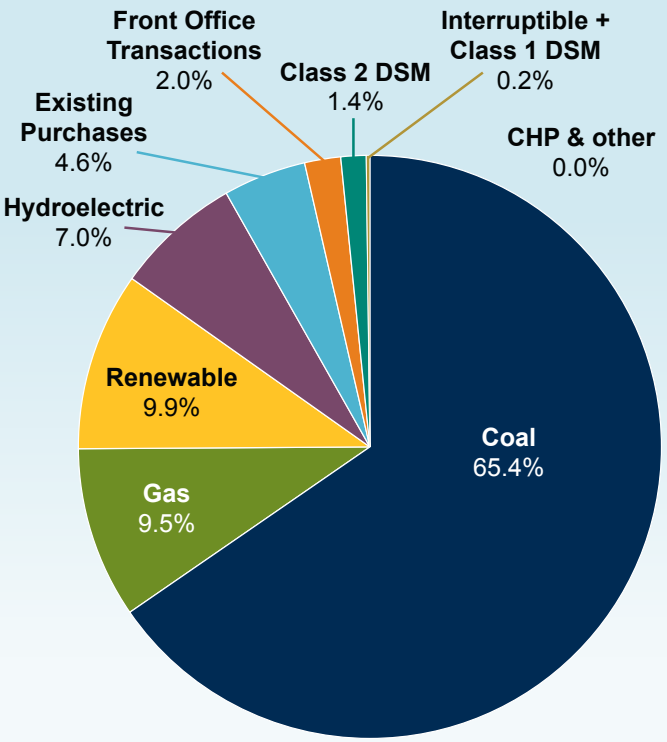
UEMS website table: Table 5.19 | Source: EIA

Note: Electricity used by the transportation sector (UTA transit) is very small (38 GWh in 2012) and is not shown on the above graphs.

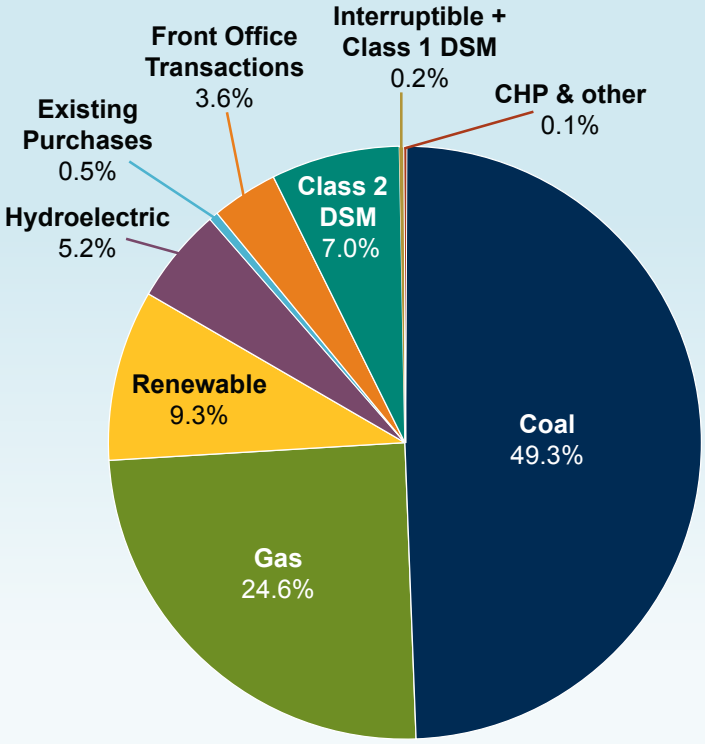
1960–2012



PacifiCorp's 2013 Resource Energy Mix



PacifiCorp's 2022 Projected Resource Energy Mix



Utah's net generation portfolio shows the fuel used to generate electricity at power plants in Utah; however, it is not a reliable indicator of the source of the electricity Utahns actually use since much of the electricity generated in Utah travels out of state (e.g., about 75% of the electricity generated at IPP is consumed in California). The source of electricity at the customer's outlet can best be estimated based on PacifiCorp's (Utah's largest electricity provider) resource energy mix. For example, in 2013, PacifiCorp customers can assume that 9.9% of the electricity they consume was generated by renewable resources such as wind, solar, or geothermal and that 7.0% comes from hydroelectric sources.

CHP – Combined heat and power.

Class 1 DSM – Demand side management (i.e., energy efficiency measures) - Class 1 programs are those for which capacity savings occur as a result of active company control or advanced scheduling. Once customers agree to participate in Class 1 DSM program, the timing and persistence of the load reduction is involuntary on their part within the agreed limits and parameters of the program. In most cases, loads are shifted rather than avoided.

Class 2 DSM – Demand side management (i.e., energy efficiency measures) - Class 2 programs are those for which sustainable energy and capacity savings are achieved through facilitation of technological advancements in equipment, appliances, lighting, and structures. Class 2 programs generally provide financial and/or service incentives to customers to replace equipment and appliances in existing customer owned facilities (or to upgrade in new construction) to more efficient lighting, motors, air conditioners, insulation levels, windows, etc. Savings will endure over the life of the improvement.

Existing Purchases – Power purchase agreements, PURPA qualified facilities (may include renewables).

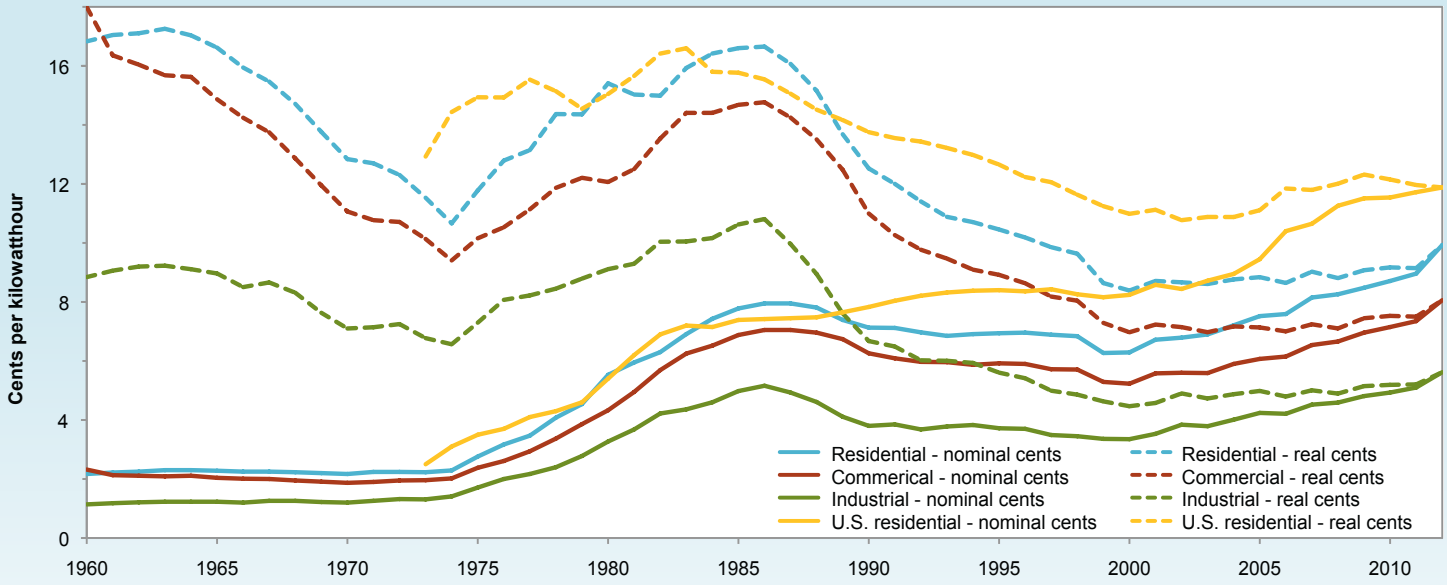
Front Office Transactions – Proxy resources that represent procurement activity made on an annual forward basis to help the company cover short positions (i.e., spot market purchases, which may include renewables).

Interruptible – Directly curtailed loads.

Renewable – Wind, geothermal, and solar.

Source: PacifiCorp IRP

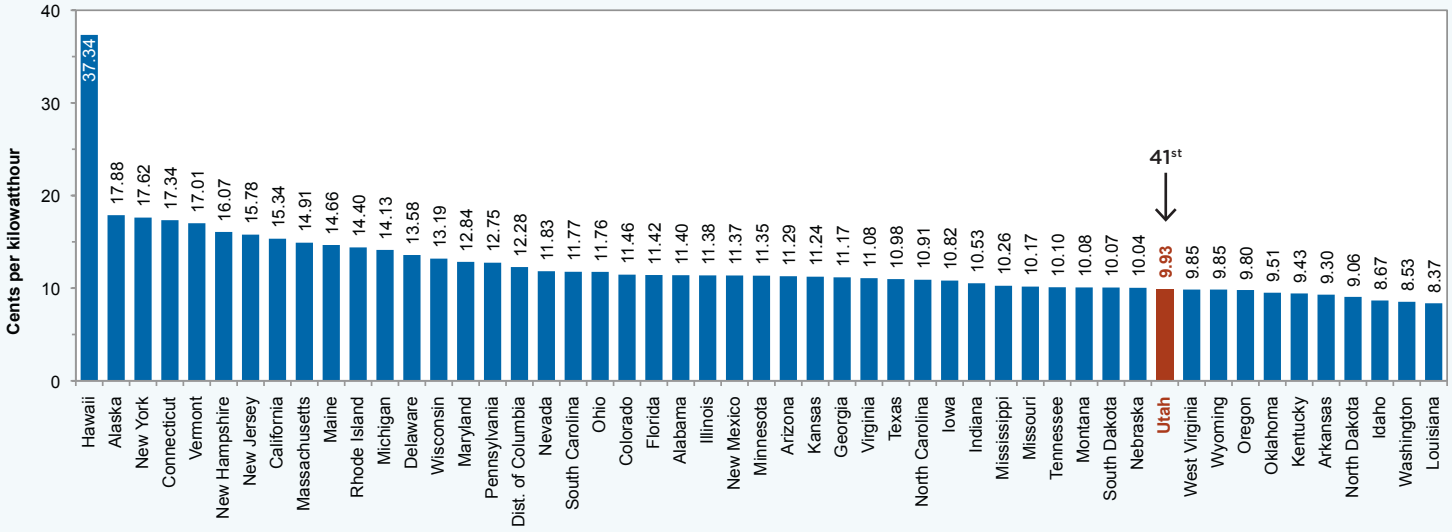
Price of Electricity in Utah by Sector, 1960–2012



The price of electricity in Utah has been on a gradual upward trend since 2000, but is still well below the national average. Utah's price for residential electricity averaged 9.9 cents per kilowatthour in 2012, 20% lower than the average residential price in the U.S. of 11.9 cents per kilowatthour.

UEMS website table: Table 5.20 | Source: EIA

Average Residential Price of Electricity by State, 2012



Utah's average price of residential electricity ranked 11th lowest in the nation in 2012; lower prices in Utah are attributed to the state's fully amortized coal-fired generation.

UEMS website table: Table 5.21 | Source: EIA

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