Utah FOUNDATION

Research Report

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UTAH'S ENERGY USE & RESOURCES

POWERING OUR STANDARD OF LIVING

HIGHLIGHTS

- The main energy sources consumed in Utah are coal, natural gas, petroleum, and hydro electricity. Coal is Utah's most-consumed energy source and is Utah's primary source for electricity; natural gas is the state's primary heating fuel.
- Abundant in-state energy resources have contributed to a low-cost, high standard of living for Utahns. In the short term, Utah prices will likely continue to be competitive compared to the rest of the country.
- In the long term, while energy prices in Utah will likely continue to rise, due to increasing domestic and global demand, prices will probably remain competitive relative to the rest of the country.
- The availability of Utah's oil, coal, and natural gas is limited; 50-100 years from now, fossil fuels will start to run out. This could either result in serious consequences for those societies built predominantly on fossil fuels, or in the innovation of new methods for powering the high standard of living that Utahns enjoy.
- Renewable and nuclear energies are currently the only known sources of energy that are not subject to the same diminishing supplies as fossil fuels. While in the short run they will be more expensive and less efficient to adopt, they remain a consistently viable source of energy into the distant future.

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The quality of life that Utahns enjoy depends, in large part, on energy. Energy is a pervasive and ubiquitous component of our daily lives. Cooling our homes in the summer, heating them in the winter, watching TV, and driving our cars to work—all are activities that require energy of one type or another. This report examines several energy issues: how we use energy, where our energy comes from, and how our energy production and consumption impact our quality of life. Finally, this report looks at the sustainability and future of Utah's energy situation.

A sound understanding of where our energy comes from, how we use it, and the implications of its use will aid policymakers and the public in determining how to provide for Utah's quality of life, both now and in the future. A strategic view of the present and future of Utah's energy supplies and demand is necessary to sustain the standard of living Utahns have come to expect.

Energy prices have been increasing rapidly during the past year, both in Utah and worldwide. Energy issues ranked as the issue of highest concern to voters on Utah Foundation's Utah Priorities Survey, which was conducted in January 2008. Specifically, gasoline prices were the energy issue of most concern for respondents, followed by renewable energy. As was evident from the Utah Priorities Survey, Utah residents are concerned about the price of fuel they put in their cars, the cost of utilities, as well as where their energy comes from.

In order to examine energy issues in Utah, this report looks at energy from two perspectives: energy use and energy production. Energy use consists of the amount and type of energy Utah consumes, as well as what that energy is used for. Energy is primarily consumed either in buildings (homes and offices use electricity and natural gas for lighting, space heating, and water heating) or in automobiles in the form of gasoline or natural gas. This examination of energy use also includes a discussion about the players in the energy sector.

Energy production, on the other hand, is comprised of the sources and methods by which energy resources, such as coal, oil, and natural gas, are converted into products consumers use, like gasoline and electricity. For example, electricity can be derived from a variety of sources, such as coal, nuclear, or hydroelectric plants. This report's review of energy production examines these different energy sources and how the types of energy we consume can have greatly different impacts on Utah, both in terms of the cost of different energies, as well as their impacts on the environment and the quality of life in Utah. The major sources of energy examined in this report are oil, coal, natural gas, nuclear, and renewable energy.

UTAH'S ENERGY USE

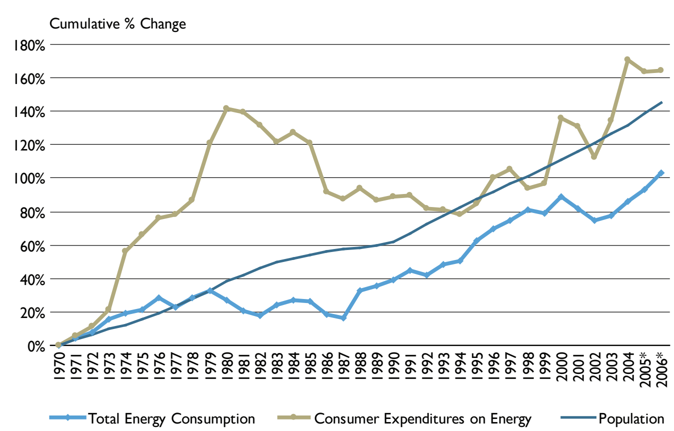
Utah is the 39th-highest ranked state in terms of per capita energy consumption, with 302.1 million British thermal units (Btu) consumed per capita annually.[1] The average per capita energy use in the United States is slightly higher, at 339.2 million Btu. Figure 1 illustrates the changes in how much Utahns consume and spend on energy over time, compared to population growth. The graph seems to indicate that consumption and expenditures have grown over time, in line with population. Also notable is that when expenditures have risen rapidly, consumption tends to decline. This is most evident in the time periods during the late 1970s, early 1980s, and in the early 2000s when oil prices where rapidly increasing.

The rate of energy consumption in Utah has a significant impact on the environment. The environmental impacts of energy use can be measured by the size of Utah's "carbon footprint." A carbon footprint is a "measure of the impact human activities have on the environment in terms of the amount of green house gases produced…measured in units of carbon dioxide."[2] While Utah ranks 39th in terms of per capita energy consumption, it ranks 14th in the nation in terms of its per capita carbon footprint.[3] The discrepancy of having a low per capita consumption level and a high per capita carbon footprint may be attributable to the types of energy Utah consumes. For example, roughly 90% of Utah's electricity is generated through the use of coal, compared with a national average of 49% (see Figures 2 and 3).

Specifically concerning electricity, Utah tends to enjoy low prices, relative to the U.S. average. Residential consumers paid 24% less than the national average (see Figure 4). This could partly be due to the fact that Utah produces much of its own electricity from coal that is produced in-state. This allows the Utah electricity market to enjoy some distinct supply advantages that could be reflected in the state's lower electricity prices.

The main types of energy consumed in Utah are coal, natural gas, petroleum, and hydro electricity. Figure 5 shows the break-down of the sources of energy Utah consumes. Coal is the most-consumed energy source, used primarily for electricity. Petroleum is the second-most consumed, with vehicles accounting for the majority of consumption. Natural gas is the state's primary heating fuel.

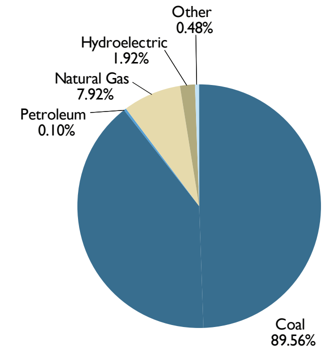
Figure 1: Utah Energy Consumption, Spending, and Population Cumulative Percent Growth, 1970-2006



*2005-2006 expenditures are estimated, 2006 consumption is estimated.

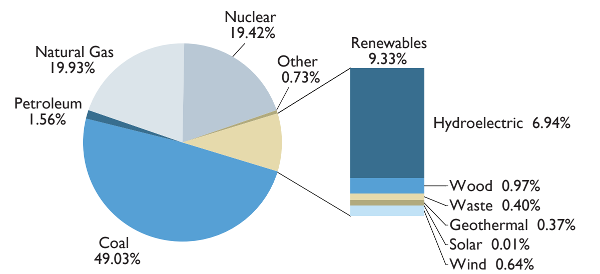
Source: Utah Geological Survey.

Figure 2: Generation of Electricity in Utah by Energy Source, 2006



Source: U.S. Energy Information Administration (EIA).

Figure 3: Generation of Electricity in the U.S. by Energy Source, 2006



Source: EIA.

Energy Consumption by Sector and Type of Use

Energy Consumption by Sector

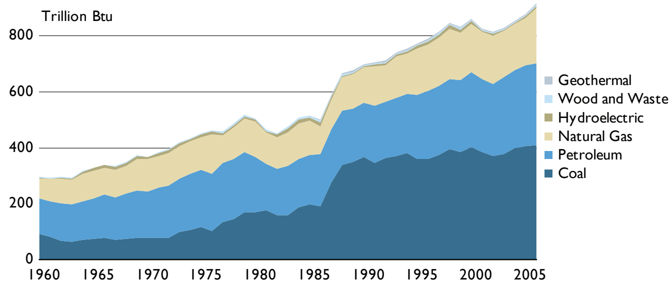
Energy use can be categorized both by sector and by type of use. The different sectors are residential, commercial, industrial, and transportation.[4] The residential sector includes private home energy consumption. The commercial sector encompasses all service-providing facilities and equipment of businesses (retail stores, doctors' offices, hairdressers, etc.), governments, public and private organizations (including religious, social, and fraternal groups), institutional living quarters (elderly care facilities, dormitories, etc.), and sewage treatment facilities. The industrial sector refers to production facilities and equipment used for producing, processing, or assembling goods. The industrial sector covers manufacturing; agriculture, forestry, fishing and hunting; mining, including oil and gas extraction; and construction. It also includes power plants. The transportation sector consists of all vehicles whose primary purpose is transporting people and/or goods from one place to another.

Figure 4: Utah Average Electricity Rates in Cents per Kilowatt Hour (kWh), December 2007

Sector	Utah	U.S.	Utah % Difference From U.S.
Residential	7.79	10.31	-24.44%
Commercial	6.00	9.41	-36.24%
Industrial	3.80	6.25	-39.20%

Source: EIA.

Figure 5: Energy Consumption in Utah by Fuel Type, 2006

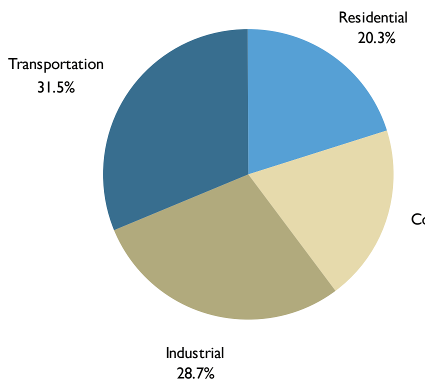


Source: EIA.

These vehicles include automobiles, trucks, buses, motorcycles, rail vehicles (trains, subways, etc.), aircraft, and waterborne vessels (ships, barges, etc.).[5]

Energy use among the sectors varies; in 2006 the transportation sector consumed the most energy, requiring 31.5% of all energy used in Utah. The industrial and residential sectors accounted for 28.7% and 20.3% of Utah's energy consumption, respectively, while the commercial sector used the smallest portion of energy, comprising 19.5% of Utah's total energy consumption.

Figure 6: Energy Consumption in Utah by Sector, 2006



Source: EIA.

Figure 7 reveals changes in consumption patterns among the different sectors. The industrial sector has grown very slightly in the amount of energy it consumes annually. However, in relation to consumption by all sectors, from 1960 to 2006 its proportional consumption decreased 26%, indicating that industry has grown less than other sectors. Conversely, the transportation and commercial sectors have seen significant growth in consumption. The transportation sector increased 10.5% in its proportional consumption, and the commercial sector increased 10.5% as well. The residential sector increased 6% since 1960.

Energy Consumption by Type of Use

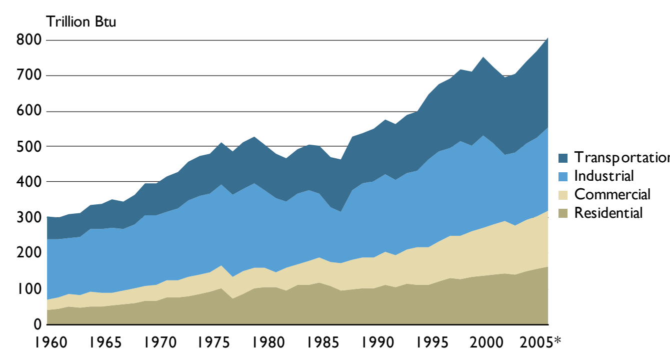
Types of use include the energy used in buildings and the energy used for transportation. The first type of energy use is the energy consumed inside buildings. The industrial, commercial, and residential sectors all have buildings which consume energy, mainly in the form of electricity and natural gas. Electricity is used for lighting, cooling, appliances (refrigerators, toasters, some stoves, microwaves, etc.), machinery, equipment, electronics, recreational use (televisions, video game consoles, radios, video players, etc.), and to a limited extent, heating. Natural gas is used primarily for heating homes, for water heating, and for some appliances, like gas stoves and ovens.

As a state, Utah consumes 85.3 trillion Btu of electricity per year, making Utah the 37th-highest electricity consumer in the United States (the average state consumes 258.8 trillion Btu).[6] Utah consumes 405.5 trillion Btu of coal annually, making it the 22nd highest ranked state in terms of coal consumption.[7] The remaining electricity (refer back to Figure 2) is generated through the use of natural gas (7.92%), petroleum (0.10%), hydroelectric power (1.92%), and other sources, such as geothermal energy, landfill gas, and municipal solid waste (0.48%).[8]

The vast majority of electric utility customers in Utah are residential. In 2006, there were 886,169 residential customers, 108,003 commercial customers, and 9,164 industrial customers.[9] The consumption of energy from utilities is fairly evenly divided among these three sectors, with the commercial (37%) and industrial (31.7%) sectors each using slightly more electricity than the residential sector (31.2%).[10]

The second type of energy use is the energy consumed by the transportation sector. Energy is necessary to power the wide variety of vehicles involved in the transportation of people and goods. This section focuses on public and private road transportation for people—in other words, car and bus use.

Figure 7: Energy Consumption in Utah by Sector, 1960-2006



* Estimated by EIA.
Source: EIA.

In 2007, the daily total vehicle miles of travel in Utah was 71,641,028 miles for all vehicle types.[11] Each day, 24,396,151 miles were traveled on the interstates alone.[12] This translates into about 3.1 million gallons of fuel being used each day for road transportation, based on an average fuel efficiency rate of 22.9 miles per gallon.[13] According to the most recent Census figures, there were 732,376 Utah residents 16 years and over who were employed.[14] Of these, 73.9% commuted to work alone. Another 15.2% commuted in carpools. 2.3% traveled to work by means of public transportation, 1.6% used other means, such as bicycles, and the remaining 7% either walked or worked from home. With nearly three-fourths of Utah employees driving to work alone, there are approximately 541,226 vehicles commuting each day, each carrying a single person, contributing to the over 71 million miles traveled on Utah roads and the 3.1 million gallons of fuel consumed on a daily basis.

The majority of the vehicles on the road in Utah are powered by motor fuels, a term that encompasses gasoline, diesel, and jet fuel. Broken down by sector, the consumption of petroleum in Utah for 2006 was as follows: 1.5% residential, 17.5% industrial, 1.2% commercial, and 79.8% transportation.[15]

There are currently 2,436,344 vehicles registered in Utah. In 2005, only 6,014 vehicles were powered by something other than motor fuel.[16] Of these vehicles, 2,680 were vehicles which used compressed natural gas (CNG), and 3,001 were vehicles fueled by 85% ethanol gasoline.[17] Additionally, there were 333 liquefied petroleum gas (LPG) vehicles.

Energy Stakeholders

Producers

There are a number of different energy producers and providers in Utah. The largest provider of electricity in Utah is Rocky Mountain Power, a subsidiary of PacifiCorp. This company serves 758,326 Utah customers.[18] Another energy provider is Intermountain Power Agency (IPA), operator of the Intermountain Power Project (IPP). IPP uses two coal-fired plants to generate an average of more than 13 million megawatt hours of energy annually. Nearly seventy-five percent of the generated electricity is exported to California: 44.6% to the Los Angeles Department of Water and Power, and the remaining 30.3% to the cities of Anaheim, Riverside, Pasadena, Glendale, and Burbank.[19] The remaining twenty-five percent of the generated electricity is purchased by 23 Utah municipalities (for a total of 14%), 6 cooperative purchasers (7%), and 1 investor-owned purchaser (Rocky Mountain Power, 4%). Another major provider is the Deseret Generation and Transmission Co-op. In addition to these major providers and producers, there are other investor-owned utilities, cooperatives, and municipal generators.

There are five petroleum refineries located in Utah, and combined they have an atmospheric crude oil distillation capacity of 167,350 barrels per calendar day.[20] The companies that own these refineries are, in order and with their respective capacities: Tesoro West Coast (58,000), Chevron USA Inc. (45,000), Big West Oil Co. (29,400), Holly Corporation Refining and Marketing (24,700), and Silver Eagle Refining (10,250).[21]

There are 4,858 active natural gas-producing wells in Utah.[22] These wells produced 385 trillion cubic feet of natural gas in 2007. Of all the wells in Utah, eight produced a combined 72.5% of 2007's total natural gas production. The wells' operators were, in order and with their percentages of the total annual production, Kerr-McGee Oil & Gas Onshore LP (21.9%), EOG Resources, Inc. (12.5%), ConocoPhillips Company (11.8%), Questar Exploration (6.1%), Western Energy Operating, LLC (5.5%), Dominion Exploration & Production, Inc. (5.3%), XTO Energy (5%), and Anadarko Petroleum Corporation (4.4%).[23] The largest retail provider of natural gas in Utah is Questar Gas, a subsidiary of Questar Corporation. Questar Gas serves about 860,000 customers in Utah.[24]

Utah produced 26 million short tons of coal in 2006, which represented about 2% of total U.S. coal production in that year. Most of Utah's coal is found in the Wasatch Plateau, Book Cliffs, and Emery coal fields. Ten mines are currently in operation in Utah. The major coal mines in Utah are owned by Canyon Fuel Co. LLC and Arch Western Bituminous Group.

The energy sector provides a significant amount of employment and revenue within Utah. In 2007, 2.9% of the state's total wages, or $1.3 billion, were earned by the energy sector's 18,707 employees.[25] Moreover, $100 million in Utah's property taxes comes from the energy sector,[26] with oil and gas severances[27] contributing another $71 million.[28] Income taxes from energy sector employees amount to another $50 million. Other sources of state revenue include mineral lease payments (which amounted to $51,601,700 in 2007),[29] fifty percent of royalties accrued from federal leases, and revenues from State Institutional Trust Lands Administration (SITLA), which benefit the school children of Utah. Additionally, the state receives revenues from motor and special fuels taxes, which totaled $365,825,900 in 2007.[30]

Consumers

Utah's energy consumers pay for and drive demand for energy, both in terms of the quantity and type of energy they want. With a state population of 2,550,063, Utah's citizens—residential energy consumers—are easily the largest group of energy stakeholders.[31] In addition to Utah's citizens, there are energy consumers from the industrial, commercial, and transportation sectors. The vast majority of utilities customers are from the residential sector. In 2006, for example, 886,169 of the 1,003,340 total electric utilities customers were residential.[32] However, the industrial (9,164 customers) and commercial sectors (108,003 customers) are extremely significant as well. They may be fewer in number, yet they each consume about the same amount of electricity as residential customers, and combined consume more than twice the energy of residential consumers. The commercial and industrial sectors are large, and as of 2005, included 193,003 firms and 65,549 private on-farm establishments.[33] Referring back to Figure 6, "Energy Consumption in Utah by Sector," one can see that all of the sectors are important stakeholders in the energy market.

Government

There are several different departments and agencies within the government that deal with energy. They operate at the local, state, regional, and federal levels. The following section lists several of the agencies and departments that deal primarily with energy concerns and are critical to the energy sector. It is important to note, however, that this list is not all-inclusive, as energy concerns are ubiquitous within the government and almost every department deals with energy issues in some way.

The main energy agencies at the local level in Utah include each municipality's energy services department and transportation planning agencies such as the Wasatch Front Regional Council or the Mountainland Association of Governments.

At the state level are the Utah Energy Council, the Utah Division of Public Utilities (which oversees service quality and makes recommendations to the Public Service Commission regarding rates of telephone, gas, electric, and water utilities), the Public Service Commission (PSC; which enacts the rules for regulating utilities and sets their rates), the State of Utah School and Institutional Trust Lands Administration (SITLA), the Governor's Energy Advisor, and the Department of Environmental Quality (UDEQ). Within UDEQ, there is the Division of Air Quality (DAQ), the Division of Environmental Response and Remediation (DERR), the Division of Drinking Water (DDW), the Division of Radiation Control

(DRC), the Division of Solid and Hazardous Waste (DSHW), and the Division of Water Quality (DWQ). Other important state level agencies include the Utah Department of Transportation (UDOT) and the Department of Natural Resources, which includes the Division of Oil, Gas and Mining, the Division of Wildlife Resources, the Division of Water Rights, and the Division of Water Resources.

Regional agencies that influence Utah are the EPA's Region VIII office, which enforces federal environmental regulations and coordinates the actions of groups, such as the Rocky Mountain Clean Diesel Collaborative (RMCDC). The Western Regional Air Partnership (WRAP) is a partnership between the Western Governors' Association (WGA) and the National Tribal Environment Council (NTEC). There is also the Western States Air Resource Council (WESTAR).

At the Federal level, the following groups and organizations are all involved in energy issues: the U.S. Department of Energy (DOE), the Bureau of Land Management (operated under the U.S. Department of the Interior and issues leases for mining and drilling on federal lands), the U.S. Forest Service (a Department of Agriculture division that deals with leases for federal lands), the Environmental Protection Agency (EPA), the Federal Energy Regulatory Commission (FERC), the U.S. Nuclear Regulatory Commission, the U.S. Senate's Environment & Public Works (EPW) Committee, the House Committee on Energy and Commerce, and the House Committee on Natural Resources.

Advocacy Groups

Energy advocacy groups in Utah act on behalf of the producers, consumers, and the environment.

Producers—Many of the major energy production companies, like Rocky Mountain Power or Questar, advocate their positions at the state and local government levels. In addition to this form of advocacy, broader coalitions lobby on behalf of the major energy industries in the Utah Legislature, Utah and federal regulatory agencies, local county and municipal governments, and through media outlets. Many of these groups also provide educational, economic, and statistical information about their respective industries in Utah. Some of the groups that operate in Utah are the Utah Petroleum Association (UPA), the Independent Petroleum Association of Mountain States (IPAMS), the American Coalition for Clean Coal Electricity, the Rocky Mountain Coal Mining Institute (RMCMI), the Rocky Mountain Gas Association/ Utah Heating & Air Conditioning Contractors Association (RMGA/UHACCA), the American Petroleum Institute (API), the Utah Mining Association, and its Utah Coal Operators Subcommittee.

Consumers—Consumer advocacy groups deal with the energy industry and largely concern themselves with utilities companies' rates. In Utah, there is the Utah Ratepayers' Association (URA), Crossroads Urban Center, Utah Ratepayer Advocate, and Utah Legislative Watch, and the Utah Ratepayers' Alliance, which is a collaborative partnership of the Salt Lake Community Action Program. There is also a government agency, the Utah Committee of Consumer Services (CCS), which advocates for reasonable utility rates on behalf of residential and small business customers.

Environment—There are many environmental advocacy groups in Utah. These groups promote environmentally sound energy policies, research alternative and/or renewable energy sources, and almost universally try to limit the use of non-sustainable energy sources. One of the best-known groups in Utah is the local chapter of the Sierra Club. Other groups which promote cleaner uses of current energy include the Northwest Energy Coalition Staff, the NextGen Energy Council, Green Corps, American Wind Energy Association (AWEA), National Geothermal Collaborative (NGC), Western Resource Advocates, and Utah Clean Energy (UCE). The Utah Wind Power Campaign is a project promoting wind power in Utah and is a joint effort by Western Resource Advocates and UCE.

Other environmental advocates focus on citizen action and participation. Some of these groups include Utah Moms for Clean Air, Utah Physicians for a Healthy Environment, and LessCoal.

There are also other environmental groups, some of which have more focused and geographically specific goals. For instance, Citizens for Dixie's Future (CDF) focuses on promoting environmentally sound "Smart Growth" planning in Washington County. Another similar group is Sevier Citizens for Clean Air & Water (SCCAW).

Having discussed how Utah uses and consumes energy, this report will now shift to a discussion of the different sources of (electricity, heat, motor fuel, etc.) The major sources of energy discussed here include: oil, coal, natural gas, nuclear energy, and renewable energy.

OIL

Petroleum, also known as crude oil, is a flammable liquid comprised of hydrocarbons and other organic compounds that is naturally occurring and found in rock formations. Petroleum can be extracted from the earth and refined in order to produce fuel for heating, power generation, and motor fuel, which is by far its greatest use in Utah.[34]

Oil Supply and Demand in Utah

Utah has three of the nation's 100 largest oil fields, accounting for 1.6% of total U.S. reserves. Utah also has oil production capabilities that account for 1.1% of total U.S. crude production.[35] Drilling operations and oil wells are found in the Uinta and Paradox Basins in eastern Utah. There are five refineries in Utah which process crude oil from Utah and other Mountain States. Utah also receives crude oil from Canada via the Frontier Pipeline.[36] Refined oil products are brought into the state from refineries in Wyoming and Montana

Figure 8: Utah Oil Reserves, Production, and Refining Capacity

Year	Known Reserves (Barrels)	Production (Barrels/Day)	Refining Capacity (Barrels/Day)	Producing Wells
1982	173,000,000	61,000	166,500	n/a
1992	217,000,000	62,000	154,500	n/a
2002	241,000,000	37,000	162,700	n/a
2006	334,000,000	49,000	167,350	2,753
Cumulative Change	93%	-20%	1%	n/a
Percent of U.S., 2006*	1.60%	1.00%	1.00%	0.50%

* Data on producing wells are from 2007.
Note: 1 barrel = 42 gallons.

Source: EIA.

via the Pioneer Pipeline, and refined products are exported from Utah via the Chevron Pipeline, which services Idaho, Oregon, and Washington.

Figure 8 illustrates the availability of Utah's oil, as well as Utah's production and refining capacities in terms of barrels (a barrel is equal to 42 gallons).[37] While Utah does have some crude oil reserves, along with production and refining capabilities, it represents a relatively small proportion of total U.S. reserves and production. However, Utah oil reserves increased by 93% between 1982 and 2006, due to the discovery of new reserves.[38] On the other hand, oil production capabilities decreased by about 20% during that same period, and refining capacity increased by only one-half of one percent.[39]

In terms of oil consumption, 46.6% of Utah's oil usage is in the form of motor gasoline; the remaining consumption is in the form of distillate fuels, liquefied petroleum gases, and jet fuel.[40] Utah both exports and imports oil to and from other states. However, Utah's combined trade and production of oil are greater than its consumption.

Utah has a sizable amount of available and accessible oil—in-state and out—that currently meets the demands of our market for petroleum products. The sustainability of Utah's oil production depends on many factors: the discovery of new reserves; increases in production and consumption efficiencies; and the availability of alternate oil sources (such as tar sands and oil shale) both in-state and among states that send crude oil and petroleum products to Utah for refining and consumption. Additionally, increases in international demand, particularly from China and India, could threaten existing supplies and prices of oil to Utah and the world.

Figure 9: Oil Product Prices, Utah and U.S., January 2008

Product	Utah	U.S.	Utah Difference From U.S.
Domestic Crude/Barrel	$80.840	$87.060	-$6.220
Residential Heating Oil/Gallon	n/a	3.140	
Retail Regular Gas/Gallon (Excluding Taxes)	2.498	2.545	-0.047
Gas Tax/Gallon	0.245	0.214	0.031
Retail Diesel/Gallon (Excluding Taxes)	n/a	2.798	
Diesel Tax/Gallon	0.245	0.220	0.025

Source: EIA.

If Utah were to produce and consume only its own reserves, with no imports or exports, while retaining its current levels of consumption, efficiency, and alternate energy sources, there would be oil available in Utah for approximately 6.3 years.[41] While this does not take into account undiscovered reserves and other sources of oil such as oil shale and tar sands, it nonetheless highlights how dependent Utah is on outside sources of crude.

Oil Prices and Externalities

Regarding prices, Utah currently enjoys less-costly petroleum when compared to the rest of the nation. However, this trend has varied over time, with periods where Utah's prices have been above national averages. Referring to Figure 9, as of January 2008, domestic crude oil cost Utahns $80.84 per barrel, compared to the $87.06 nationwide average. While Utah currently enjoys lower fuel costs than the rest of the country, as can be seen in Figure 10, Utah prices generally track national trends very closely. One reason for lower prices in Utah could be that the state is a relatively isolated market in terms of geography, which affects transportation costs. Utah's geography isolates its oil economy somewhat from the rest of the country, perhaps making Utah less susceptible to national changes in price. However, while Utahns pay less for fuel than their peers nationwide, they pay 14% more in gas taxes than the national average, which could lead to overall "prices at the pump" that are equal to or higher than national averages.

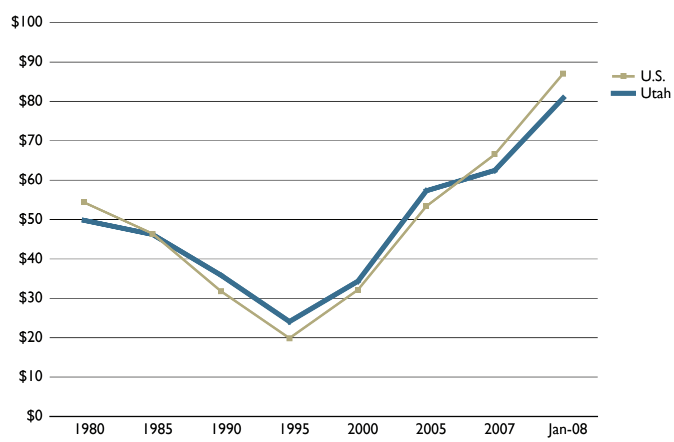
In addition to the market for gasoline and other petroleum products, the production, refining, and use of oil affects Utah's environment. The production of oil, including its extraction, affects the landscape and environment where the oil is procured. This can lead to disturbance of wildlife and existing rock formations. Oil spills also have a negative environmental impact. The refining of oil releases pollutants—including carbon dioxide, a greenhouse gas—into the air. While the causal link of greenhouse gases and global warming is debated, there are health effects for individuals who inhale the air-born waste products of refinery emissions. Finally, the use of oil, particularly in the form of motor fuel, emits carbon dioxide and other pollutants and therefore contributes to the health and environmental effects already mentioned.

The Future of Oil in Utah

The future demand for petroleum products in Utah will depend on a number of factors. First, as illustrated earlier in the report, increases in population and wealth in Utah will probably result in increased demand for petroleum products, especially motor fuel. These increases in demand for gas and other petroleum products in Utah will end up competing with increased demand from other fast-growing areas of the United States, as well as with other nations across the globe. India and China, in particular, have increasing demand as they grow in their ability to purchase cars for personal use and trucks for transporting increasing amounts of consumer goods.

Given current supply levels and reserves, these demand shifts will likely lead to higher prices for Utahns. According to Figure 11, as of April 22, 2008, the average price of a gallon of regular gasoline in Utah was $3.38 compared to $3.51 nationwide. This was up from a year earlier, when the price for the same gallon of gas in Utah was $2.88 and $2.85 nationwide. This represents increases of 17.62% and 23.11%, respectively. While global events—such as conflict near and

Figure 10: Oil Price Per Barrel, Utah and U.S.



Source: EIA.

Figure 11: Regular Unleaded Gasoline Price Per Gallon, Including Taxes, Utah and U.S. Averages

	Utah	U.S.	Utah Difference From U.S.
Price as of 04/22/2008	$3.384	$3.511	-$0.127
Price one year previous	2.877	2.852	0.025
% increase	17.62%	23.11%	

Source: AAA Daily Fuel Gauge Report.

in oil-producing countries like Iraq—may account for some of this increase, most of the increase in prices appears to be coming from increased global demand.

Furthermore, while demand is increasing, known global reserves of oil are decreasing. Oil is a non-renewable resource. Thus, the supply is fixed and will only change when and if new reserves of oil are discovered. Diminishing supplies will only exacerbate the price increase caused by increasing demand. While there are a known number of oil reserves, only some of these reserves are easily accessible. As oil prices increase, however, these reserves will become more and more financially feasible to exploit. Nevertheless, the exploitation of some of the harder-to-get resources is subject to much political debate. Many reserves in the United States are located on land that is federally protected for environmental and other reasons. Obtaining leases to retrieve oil reserves on this land can be difficult for petroleum companies. International agreements, such as environmental protocols and federal and state legislation regarding the production and use of oil, also have the potential to shift or restrict the supply and demand of the oil markets. Furthermore, increases in efficiency, such as fuel-efficient and hybrid cars, and reduced oil consumption could ease some of the pressures from demand for oil resources.

Oil Substitutes

When considering the state of current supply and demand for petroleum products, it is important to consider petroleum product substitutes. If prices for gasoline and other petroleum products remain high, demand for petroleum substitutes will likely increase. Such substitutes could decrease demand for these products in the areas where such substitutes are available. These substitutes, if widely used, could actually increase the length of time that oil reserves will last, as they have the potential to decrease the demand for oil. With the rapid increase in demand worldwide, however, there is no guarantee that petroleum substitutes will decrease the market price of oil.

In addition to traditional sources of petroleum-based products, oil shale and tar sands are two alternate natural resources that can be converted *into* petroleum products. Utah contains some of the largest deposits in the world of both of these materials.

Marlstone, commonly known as oil shale, is a material found in rock formations that can be converted through destructive distillation into a base material for petroleum products, like gasoline. Colorado, Wyoming, and Utah collectively have the largest deposits of oil shale in the world. These deposits are in the area known as the Green River Formation, which is a set of basins that spans the states. Utah's deposits are found mostly in the Uinta Basin. While Utah's oil shale reserves are smaller than Colorado's or Wyoming's, most of Utah's oil shale is of a high-grade variety and is easily accessible, as it is located in thick seams near the surface.[42] The problems that face oil shale as a viable oil-producing material include the technological feasibility of extracting the material and producing oil from it, the economic viability of the processes compared to traditional oil extraction, ownership issues related to the land on which the resource is located, and environmental considerations related to mining and procuring oil from marlstone. Technologically, the production of oil shale is feasible, but expensive. The Rand Corporation estimated that in order for petroleum products from oil shale to be competitively priced with regular petroleum, the price of petroleum would need to be between $70-95 per barrel (in 2005 dollars). These costs would decrease over time due to lowering prices of technology and increasing economies of scale.

Tar sands, oil sands, or bituminous sands are a material from which heavy-grade crude oil can be extracted and processed in traditional oil refineries. While significant energy is required to extract the sand, as with oil shale, it becomes a more financially viable resource as the price of traditional oil goes up. Canada and Venezuela, both of which contain and exploit large deposits of tar sands for significant amounts of oil production, have already set a precedent for feasibly developing this resource. The problems facing the development of tar sands as an oil substitute are similar to those facing oil shale, including environmental damage from the extraction, production, and use of the material, as well as financial, technological, and ownership issues. [43]

In addition to materials that can directly act as substitutes for oil, there are several technological developments that can be substituted for motor fuel, specifically by allowing automobiles to operate using non-oil-based alternate motor fuels. The most prominent of these include bio fuels, natural gas, electricity, and fuel cells.

Bio fuels, including ethanol and bio diesel, are motor fuels that are created most often from corn, sugar cane, vegetable oil, and other oils. This fuel is then used in cars that have engines specifically modified to use bio fuel. Some cars are capable of using both bio fuels and regular gasoline. The production of these fuels depends of the development and availability of agricultural resources for this purpose. Problems with this fuel source include competition for land and markets for traditional uses of corn and sugar cane for food. This can lead to a rise in food prices.

There are also environmental concerns that include the development of additional land for bio fuel purposes. The process of growing, producing, and using bio fuels produces significantly fewer emissions than oil does, having a near-zero environmental impact, due partly to the carbon dioxide absorbed by bio-fuel plants as they are growing.[44] In Utah, bio fuels are not widely used. Consumer access to bio fuels is limited to four refueling stations.[45]

Compressed natural gas, or methane, is another alternative to motor fuel that has a significantly smaller environmental impact when compared with gasoline. Natural gas burns cleaner than regular gasoline and is about as fuel efficient. Natural gas is a non-renewable resource, however, and is therefore subject to the same supply constraints as oil.

Natural gas is readily available in Utah as a motor fuel. There are currently 91 compressed natural gas stations in Utah, with 20 open for public use; the rest are used to fuel state fleet vehicles, school buses, and other public vehicles. In terms of cost, the availability of natural gas from existing gas fields in Utah keeps prices low within the state. As of April 2008, the price of natural gas in Utah was a little over $0.60 per gallon of natural gas, compared to $2.50 per gallon for natural gas in California, and over $3.30 for a gallon of regular gas in Utah.[46]

Other sources of alternative motor fuels include electric-powered vehicles and hydrogen fuel cells. Electric-powered vehicles run on electricity. They must be "plugged-in" in order to refuel. However, there are significant problems with current electric vehicles in that they are often under-powered and expensive compared to gasoline vehicles. They also often lack range and an adequate number of places to recharge. Hydrogen fuel cell cars run on electricity that is produced from the reaction of hydrogen and oxygen. As with electric-powered vehicles, there is the issue of refueling stations, but there are no emissions from the chemical reaction except for water. Hydrogen is also a plentiful resource. As is the case with both types of fuel, the energy used to make fuel cells themselves and produce the electricity in electric powered cars often requires the burning of coal or other energy-intensive and carbon dioxide-emitting processes. These effects, at the production stage, off-set emissions gains at the consumer/automobile level.[47]

COAL

Coal is a combustible brown-black sedimentary rock that is the most widely distributed fossil fuel in the world. The greatest demand for coal is from power plants that burn it to generate electricity. Ninety-two percent of coal is used to generate electricity, providing approximately half of all electricity in the U.S. In Utah, coal is used to generate about 90% of all electricity.[48] Generating this electricity uses about 60% of Utah's annual coal production.[49] In addition to generating electricity, coal is also needed for industrial uses, such as primary metals, cement, chemicals, and paper.

Coal is found in 37 states and is actively mined in 27 states. These states are classified into three major coal regions: Appalachian, Interior, and Western. The Appalachian region is dominated by West Virginia, which is the largest producer in the region and the 2nd largest producer in the U.S. The greatest concentration of mines is also found in this region, which produces roughly one-third of all U.S. coal.[50] The Interior region supplies roughly 13% of U.S. coal; the state of Texas is the largest producer in this region and accounts for approximately one-third of the region's total production.[51]

The Western region, which includes Utah, is the largest coal-producing region in the U.S., and accounted for 53% of all U.S. coal in 2006. The Western region has the lowest number of mines per region in the U.S., primarily due to the dominance of large surface mines with high productivity. Wyoming is the leading coal producer in the region, accounting for 72% of the region's total and boasts the largest surface mine in the U.S., the Black Thunder Mine.[52]

Figure 12: Coal Production in the Western U.S., 2006

State	Production (Million Short Tons)
Wyoming	446.7
Montana	41.8
Colorado	36.3
North Dakota	30.4
New Mexico	25.9
Utah	26.0
Arizona	8.2
Washington	2.6
Alaska	1.4
Total	619.3

Source: EIA.

Figure 13: Utah Coal Reserves by Coal Field, 2007
Millions of Short Tons

Coal Field	Original Principal Reserves	Original Recoverable Reserves	Cumulative Production 1870-2007	Remaining Recoverable Reserves	% of Total Remaining Recoverable Reserves
Kaiparowits	22,740.0	9,096.0	0.1	9,095.9	61.7%
Wasatch Plateau	6,378.9	1,913.7	616.4	1,297.3	8.8%
Alton	2,155.0	1,055.7	0.0	1,055.7	7.2%
Kolob	2,014.3	805.9	0.9	805.0	5.5%
Emery	2,336.0	817.6	13.3	804.3	5.5%
Book Cliffs	3,527.3	1,033.5	342.0	691.5	4.7%
Henry Mountains	925.5	484.7	0.0	484.7	3.3%
Sego	696.3	208.9	2.7	206.2	1.4%
Mt. Pleasant	249.1	99.6	0.0	99.6	0.7%
Tabby Mountain	231.7	69.4	0.0	69.4	0.5%
Vernal	177.1	53.2	0.5	52.7	0.4%
Coalville	186.0	55.8	4.3	51.5	0.3%
Salina Canyon	86.4	30.2	0.5	29.7	0.2%
Wales	12.2	3.7	0.8	2.9	*
Harmony	1.3	0.4	0.0	0.4	*
Lost Creek	1.1	0.4	0.0	0.4	*
Sterling	2.0	0.6	0.3	0.3	*
Total	41,720.2	15,729.3	981.8	14,747.5	

*Value less than 0.1%

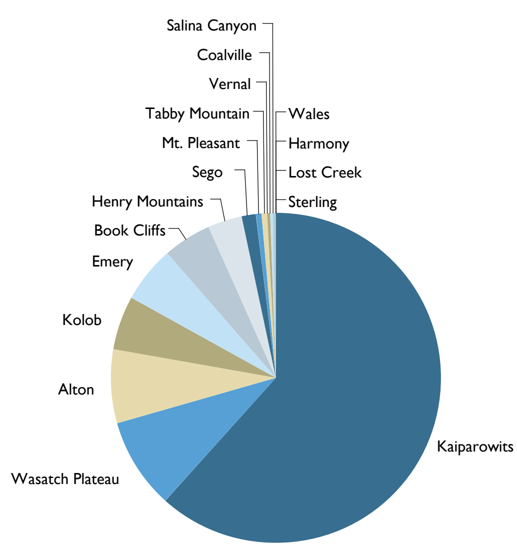
Source: Utah Geological Survey.

Coal Production and Supply

Utah ranks 12th in the nation for coal production and produced 26 million short tons of coal in 2006, which represented about 2% of total U.S. coal production in that year.[53] Most of Utah's coal is found in the Wasatch Plateau, Book Cliffs, and Emery coal fields.[54] Ten mines are currently in operation in Utah. Two of these mines are considered major U.S. coal mines: Dugout Canyon Mine, located in Carbon County, and Sufco Mine, located in Sevier County.[55]

The United States has over 600 facilities that use coal as the dominate fuel source for creating electricity. Of these, approximately 500 are 'power plants' operated by utility companies; the remaining facilities are at industrial, commercial, governmental, and institutional sites that use the majority of the electricity they produce from coal onsite.[56] An additional 120 coal plant projects are in the construction, permit, or project design phases and are expected to be completed over the

Figure 14: Percent of Total Remaining Recoverable Reserves by Utah Coal Field



Source: Utah Geological Survey.

next two decades. When comparing the cost of building a new coal power plant with other types of electrical generating plants, such as nuclear or natural gas plants, coal plants cost less to build.[57] Estimates to build a new clean coal power plant put costs at $1.5 billion and four years of construction.[58] Comparatively, new construction of a nuclear power plant can cost over $2 billion and can take five years to complete. However, this is only a comparison of up-front costs and does not consider the cost per megawatt produced by such plants. Furthermore, the ability to build coal plants is under threat due to political and environmental pressures at the state and national levels, as well as potential federal legislation concerning the building of coal plants.

The U.S. holds 25% of worldwide coal reserves;[59] the Demonstrated Reserve Base (DRB) is estimated to contain 491 billion short tons of coal (a short ton is 2,000 pounds, also referred to as a ton). This is greater than the remaining reserves of both natural gas and oil.[60] Not all of this coal is accessible, however; factors such as land use, property rights, physical environment, and the recovery rates by type of mining affect the ability to obtain coal. Calculations by the Energy Information Administration estimate that 261 million short tons (of the 491 billion short tons in the DRB) are recoverable.[61] Worldwide, total recoverable coal is estimated to be 998 billion short tons; given current demand levels and no change in the levels of recoverable reserves, coal production could continue for approximately 164 years.[62]

Figure 13 illustrates remaining recoverable reserves in the major coal fields in Utah. Coal mining currently takes place in only three Utah counties: Emery, Sevier and Carbon. However, large tracts of coal exist in the Kane and Garfield counties. These fields have the potential to be mined, if environmental concerns could be addressed and economic conditions met. Between 1870 and 1981, 490 million short tons of coal were extracted from Utah. In the 22-year period from 1982-2004 an additional 490 million short tons of coal were mined; this significant increase was made possible by advancements in mining technology.[63] Much of Utah's 14 billion short tons of recoverable coal reserves have yet to be tapped. However, much of these reserves are located on federally protected land. Given current production and consumption levels, Utah coal should last another 40-45 years.[64]

Coal Prices

Figure 15: Average Mine Price of U.S. Coal

Year	Average Mine Price Per Short Ton
1995	18.83
1996	18.50
1997	18.14
1998	17.67
1999	16.63
2000	16.78
2001	17.38
2002	17.98
2003	17.85
2004	19.93
2005	23.59
2006	25.16

Note: Average mine price is the open market price for coal. It excludes transportation and insurance costs.
Source: EIA.

In addition to the abundance of coal, its low cost relative to other types of energy sources encourages its demand. Since 1976, coal has been the least expensive fossil fuel used in generating electricity.[65] In 2006, natural gas was the most expensive fossil fuel at $6.94, petroleum at $6.23, followed by coal at $1.69 per million Btu.

Figure 15 illustrates average open mine coal prices over the last decade. Projected prices for 2030 are lower than current prices, which are $23.45 per short ton.[66] While the average open market mine price of coal is $25.16 per short ton, the U.S. average cost of delivered coal is much higher, given the distance coal travels and rising transportation costs. Coal prices per short ton vary by sector; it costs $34.26 to deliver coal to electric utilities, $51.67 to deliver coal to other industrial plants, and $92.87 to deliver coal to coke plants.[67] Transportation issues, such as train derailment, continuing train track improvements, fuel costs, and barge sinkings, all contribute to the end price of coal. As a result, shipping costs can exceed actual mining costs. In order to offset these costs, many coal-fueled power plants are built in close proximity to mining locations.

Figure 16: Average Distance Shipped Per Ton for Utility Contract Coal by Supply Region and Transportation Mode

Supply Region	Miles Shipped 1979	1987	1995	1997
Appalachia				
Train	336.6	334.2	392.1	382.2
Barge	110.9	171.2	219.0	233.8
Truck	41.4	29.3	51.4	47.7
Multimode	446.1	483.8	471.9	435.7
Other	8.2	7.1	9.1	9.2
Region Average	260.7	303.3	338.5	324.5
Interior				
Train	159.4	145.1	123.4	121.8
Barge	797.8	688.0	689.5	785.3
Truck	49.1	21.9	18.3	28.6
Multimode	331.0	437.3	365.9	90.0
Other	--	7.5	7.5	7.0
Region Average	242.3	234.6	160.1	188.9
Western				
Train	814.0	973.5	1,018.9	1,096.6
Barge	--	--	1,409.0	--
Truck	19.7	13.7	18.4	17.6
Multimode	1,325.3	1,372.3	1,540.4	1,595.8
Other	100.6	70.7	67.3	273.0
Region Average	770.2	736.9	943.6	1,086.8
United States				
Train	484.5	517.1	725.9	793.8
Barge	306.6	361.1	295.8	307.1
Truck	38.2	20.0	25.1	31.5
Multimode	707.2	684.0	1,062.4	1,088.3
Other	50.3	49.4	50.7	89.8
U.S. Average	436.0	436.1	637.1	714.0

Notes: Multimode includes shipments that use any combination of rail, truck, barge and collier transportation. Other includes shipments for which mode is unknown, as well as conveyor, tramway, and slurry pipeline. Import records are excluded.

Source: EIA.

As illustrated in Figure 16, coal from the Western region travels further than coal from both the Interior and Appalachian regions. Western-region coal travels an average of 1086.8 miles. Broken down by transportation method, Western coal travels an average of 1096 miles by train, 17.6 miles by truck, and 1595.8 miles in multimode (which includes any combination of rail, barge, truck, and collier transportation).[68] In comparison, average distances from origin to destination for all methods of transportation for the Interior region are 188.9 miles and 324.5 miles for the Appalachian region.[69]

The Future of Coal in Utah

While the increased costs and risks associated with transporting coal drive up the cost of delivered coal, the demand for coal is still expected to rise, given increasing demand for electricity. Also, states adopting renewable portfolio standards, which require a certain percentage of electricity to be generated from renewable resources, could greatly affect demand for coal. Until technology develops to make these resources more cost-efficient, switching to natural gas or renewable energy for electricity needs could increase costs significantly in the short term. By 2030, U.S. demand for coal is expected to increase 48%. Worldwide demand for coal is projected to increase 73%, driven largely by increased energy consumption in China and India.[70] The worldwide market for energy consumption is expected to increase 57% from 2004-2030, with electrical generation in 2030 projected to be nearly double the rate in 2004.[71] By 2030, the worldwide energy consumption from coal-based resources is expected to increase to 28%, largely due to increasing oil prices.[72]

Coal production has been able to keep up with growing coal demand primarily because of increased mining productivity, due to advancements in mining technologies and machinery and the development of larger surface mines. However, using coal to meet growing demands for energy does have challenges. These challenges include environmental concerns, as well as economic issues, such as the feasibility of financing new coal plants and the costs and transportation associated with opening up new tracts of coal.

The primary environmental concern, in regards to coal, is that the burning of coal releases impurities into the air, such as sulfur and nitrogen. These particles can combine with water vapor and fall back to the earth as acid rain. The effects of acid rain are numerous: acidification of lakes and rivers, accelerated decay of buildings, and health problems, such as asthma and emphysema.[73] Additionally, the burning of coal releases carbon dioxide emissions into the air. Carbon dioxide is the most prevalent greenhouse gas in the atmosphere, and rising levels have broad implications for global climate change.

Different methods exist for combating the issue of harmful emissions. Carbon sequestration is an example of a new technology that could potentially address the issue of rising levels of carbon dioxide in the atmosphere. Through carbon sequestration, carbon emissions are captured and permanently stored to reduce the build up of greenhouse gases. Additionally, there are several initiatives using new technologies to make coal a cleaner source of energy by focusing on ways to reduce emissions, increase energy efficiency, and offer alternative methods to obtain energy from coal.[74] Coal gasification, coal washing, and advanced combustion systems are examples of new technologies that are being researched—and in some cases are already employed commercially—in efforts to reduce the environmental and health impacts of using coal for energy.

Increases in federal funding for clean coal technologies research can help offset some of the costs associated with constructing new, clean coal plants, as well as address some of the environmental and health concerns over using coal for energy. The U.S. government has developed climate change policies to address these issues through voluntary and incentive-based programs.

NATURAL GAS

Natural gas is a gaseous fossil fuel comprised of methane and other gases. Natural gas is found in coal beds (in the form of coal bed methane), natural gas fields, and oil fields. In Utah, natural gas is a major source of energy, particularly for heating homes and other buildings. Approximately 85% of homes in Utah are heated using natural gas, compared to 51.2% of homes nationwide.[75] Natural gas is also used to generate electric power.

Figure 17: Natural Gas Known Reserves and Production in Utah Millions of Cubic Feet

Year	Known Reserves	Production	Producing Wells
1980	1,201,000	87,766	n/a
1990	1,510,000	145,875	822
2000	4,235,000	269,285	4,178
2006	5,146,000	348,040	4,506
Cumulative Change	328%	297%	n/a
Percent of U.S., 2006	2.40%	1.80%	1.00%

Source: EIA.

Natural Gas Supply and Consumption

Utah has two major natural gas fields in the state which rank among the top 100 natural gas fields in the nation. Utah's production of natural gas is concentrated in the Uinta Basin area; in 2006, Utah as a whole produced 348 billion cubic feet of natural gas, which constituted 1.8% of total U.S. production.[76] In 2006, Utah also had reserves of 5.6 trillion cubic feet of natural gas, making up 2.4% of all reserves nationwide.

Natural gas has grown in importance to Utah as a vital natural resource over the last two decades.[77] Between 1980 and 2006, Utah natural gas reserves grew by 328.48% due to the exploitation of existing reserves and the discovery of new reserves. Production also increased during the same period from 87.7 billion cubic feet to 348 billion cubic feet, an increase of almost 300%. Another notable fact regarding Utah's natural gas production is that coal bed methane, which is an unconventional form of natural gas derived from coal seams, accounts for more than one-fourth of Utah's natural gas production.

Over four-fifths of Utah households use natural gas for heating; however, Utah only consumes about one-half of its own production. A well-developed infrastructure for the production and transportation of natural gas allows substantial volumes of natural gas to be imported into Utah from Wyoming and Colorado. For example, both the Questar Pipeline—which runs from the gas fields in Wyoming and Colorado—and the Kern River Gas Transmission Pipeline—which runs from Opal Hub in Wyoming through the Salt Lake City area to markets in Southern California—import natural gas into the state.[78] Both of these pipeline systems also move gas produced in Utah to other states. Additionally, natural gas has lower costs of extraction and extraction technology, compared with other, harder-to-extract energy resources.

Natural Gas Prices and the Future of Natural Gas

Favorable market conditions have and continue to provide Utahns with inexpensive natural gas compared to the rest of the nation, including low prices for compressed natural gas (a gasoline substitute). Well-head prices, which are basically natural gas wholesale prices, are somewhat below national averages, and residential prices, as can be seen in Figure 18, are more than 47% lower than the national average.

Figure 18: Utah and U.S. Residential Natural Gas Average Price, 2007 Dollars

Year	Utah	U.S.
1980	$6.89	$9.26
1985	9.37	11.79
1990	8.38	9.20
1995	6.45	8.24
2000	7.47	9.34
2005	10.31	13.48
2007	9.44	13.01
Jan '08	8.24	12.12

Source: EIA, Inflation data from Bureau of Labor Statistics (BLS).

Furthermore, while inflation-adjusted prices for natural gas rose by 40.5% between 1980 and 2007, prices in Utah rose only 36.92%. The abundant gas supply in the Rocky Mountain region helps keep prices for Utah consumers lower than almost any other area of the country.

In the future, natural gas will continue to play a critical role in Utah's energy infrastructure. Compared to coal and oil, natural gas is a very clean source of energy, with minimal environmental and health effects.

While worldwide demand for natural gas will increase, the constraints imposed by demand for natural gas are not nearly as heavy as those imposed by the rapid growth in demand for oil, even given limited supply. If new reserves of natural gas are discovered and developed, Utah will be able to continue to rely on natural gas for heating homes and other uses for many years.

Current trends indicate that, in terms of fueling vehicles, natural gas cars, truck, and buses will become more and more common on Utah roads. This is due to increased manufacturing of such vehicles, their relatively low environmental impact, the tax credits associated with such vehicles, and the cheap prices for compressed natural gas in Utah.

NUCLEAR ENERGY

Nuclear power is a source of energy derived from the fission (splitting) of atoms, rather than the burning of fuel, such as coal, to produce electricity. The fission process releases energy in the form of heat, which in turn boils water. The resulting steam fuels turbines which generate electricity. Nuclear power accounts for approximately 19% of total electricity generated in the U.S.[79] Figure 19 illustrates the states that receive nuclear-generated energy, as well as their share of total energy generation. The bulk of the electricity Utah consumes comes from coal and natural gas sources. The state neither generates, nor imports, power from nuclear power plants.[80]

Figure 19: State Nuclear Fuel Share as a Percent of Total Generation, 2007

State	Nuclear Fuel Share (Percent)
Alabama	23.7
Arizona	23.7
Arkansas	28.1
California	16.8
Connecticut	48.9
Florida	13.0
Georgia	22.4
Illinois	47.8
Iowa	9.1
Kansas	20.7
Louisiana	18.4
Maryland	28.7
Massachusetts	10.8
Michigan	26.2
Minnesota	24.4
Mississippi	18.8
Missouri	10.3
Nebraska	33.5
New Hampshire	46.0
New Jersey	50.7
New York	29.0
North Carolina	30.7
Ohio	10.1
Pennsylvania	34.0
South Carolina	51.2
Tennessee	30.2
Texas	10.1
Vermont	73.7
Virginia	34.7
Washington	7.6
Wisconsin	20.4

Note: Data are preliminary 2007 figures.
Source: Nuclear Energy Institute.

Nuclear reactors are fueled by uranium, a very dense radioactive material that occurs naturally in many rocks and soils. Mining uranium occurs primarily in the Western states of Wyoming, Colorado, Nebraska, New Mexico, Arizona, Utah, Washington, Alaska and Nevada; uranium is also mined in South Dakota, Texas, and Michigan.[81] Utah historically has been the third-highest uranium-producing state in the nation; however all of Utah's uranium mines ceased operations by 2000.[82] Renewed interest and rising uranium prices have prompted the reopening of Utah's uranium mines and mills.

Figure 20: Major U.S. Uranium Reserves

Source: EIA.

Once mined, and before being used in the production of nuclear energy, uranium must be processed. At the end of 2007, there were six uranium processing plants in the U.S. that supplied fuel to the 31 states that are home to the nation's 66 nuclear power plants.[83]

Nuclear Power Supply and Demand

Electricity generated by nuclear power is expected to increase through 2030. The previous two decades saw an annual average growth rate of 1.4% in total net electrical generation of nuclear power, even though there were no additional nuclear plants constructed during this time.[84] These increases were possible because of plant upgrades and increased efficiencies in generating capacity. Capacity factor is a measurement of a plant's maximum electrical generation in relation to the actual electricity produced. Nuclear power plants operated with a capacity factor of 89.6% in 2006.[85] Comparatively, coal plant capacity factors were 72.6%, other renewables were 45.6%, hydroelectric was 42.4%, and natural gas was 38.3%.[86]

As can be seen in Figure 21, nuclear power plants have one of the lowest average total costs, despite having high maintenance and operations costs; this is because of cheap fuel, as well as the need for secure and safe containment systems. Operating and maintenance costs for a nuclear power plant constitute approximately 75% of total costs, while the operating and maintenance costs of natural gas and coal power plants typically make-up less than a quarter of their total production costs.[87] The high maintenance and operating costs for nuclear plants are offset by the low cost

Figure 21: Average Operating Expenses for Major Investor Owned Utilities, 2006

Plant Type	Mills per Kilowatt Hour
Operation	
Nuclear	8.93
Fossil Steam	3.23
Hydroelectric	5.11
Gas Turbine and Small Scale	3.00
Maintenance	
Nuclear	5.68
Fossil Steam	3.19
Hydroelectric	3.44
Gas Turbine and Small Scale	2.29
Fuel	
Nuclear	4.85
Fossil Steam	23.17
Hydroelectric	--
Gas Turbine and Small Scale	52.46
Total	
Nuclear	19.46
Fossil Steam	29.59
Hydroelectric	8.54
Gas Turbine and Small Scale	57.75

Note: A Mill is a monetary cost and billing unit equal to 1/1000 of U.S. dollar, equivalent to 1/10 of one cent.

Source: EIA.

of using uranium for fuel. Costs of fuel for nuclear power are low because nuclear power plants do not require the same volume of fuel to produce a given amount of electricity as coal power plants. Nuclear power plants typically only need to refuel every 18-24 months. Fuel costs, as a percentage of total electrical production costs for nuclear power, are approximately 26%, compared to 77% and 92% for coal and natural gas, respectively.[88]

Nuclear Energy and the Environment

The byproducts of nuclear energy are cleaner than those produced by burning fossil fuels for power. Nuclear plants produce near-zero emissions of carbon dioxide, sulfur oxides, and nitrogen oxides. However, nuclear plants do produce a small amount of air emissions from the processing of uranium. If nuclear power were utilized as an alternative to other fossil fuel power sources, nuclear-generated electricity could decrease carbon dioxide emissions by approximately 700 million metric tons each year.[89]

While nuclear energy does not emit particles or ashes into the air, it does produce solid waste byproducts that must be stored. While these waste products are small compared to the electricity produced, the dangerous nature of nuclear waste products requires specific safety measures.[90] Most nuclear waste is low-level radioactive material; however, spent fuel is highly radioactive and is subject to special regulations that govern its storage and disposal. Utah currently has a low-level waste disposal facility, located in Clive, which is located 74 miles west of Salt Lake City.

Highly radioactive materials can be stored in dry cask storage or in spent fuel pools. When using spent fuel pools, spent radioactive fuel rods are stored under at least 20 feet of water, protecting workers near the pool from radiation. Once spent fuel rods are cooled in the pools for at least one year, radioactive materials can be placed in dry cask storage, typically a steel cylinder surrounded by inert gas. Radioactive materials are currently stored either at the producing facility, or at U.S. Department of Energy facilities.[91] There are plans by the U.S. Department of Energy to develop storage facilities for long term use. The USDOE is preparing a license application to open Yucca Mountain in Nevada, an underground repository for spent nuclear fuel and high-level radioactive waste, as early as 2017.[92] Currently, nuclear waste is stored in 120 different locations in 39 states. These storage systems are temporary and are not designed to store radioactive materials indefinitely.[93]

The Future of Nuclear Energy in Utah

Increasing demands for energy, climate and clean air concerns, and awareness of diminishing fossil fuel resources have all contributed to the growth of nuclear power. While Utah does not currently have a nuclear power plant, there has been discussion of building a nuclear plant in the state. Transition Power Development, LLC, is expected to submit an application to the U.S. Nuclear Regulatory Commission in 2010 for a new nuclear power plant to be built in Utah. The estimated construction costs of building a nuclear power plant in Utah run as high as $2-3 billion.

While the plant could have an operational lifespan of as long as 80 years, nuclear power plants are typically licensed to operate for only 40 years.[94] To extend production beyond 40 years, nuclear plants must apply for re-licensing and meet Nuclear Regulatory Commission requirements for safety issues, as well as pass environmental reviews. Furthermore, before a plant can begin operations, it must ensure that funds have been secured to decommission the plant once operations cease. Removing the plant from service and reducing residual radioactivity levels within 60 years of shutting down the

Figure 22: Renewable Market Share of Electricity Net Generation by State 2005 and 2006, Thousands of Kilowatt Hours

	2005			2006		
State	Total State Generation	Percent Renewable	Percent NonHydro Renewable	Total State Generation	Percent Renewable	Percent NonHydro Renewable
Alabama	137,948,581	10.0	2.7	140,895,441	7.9	2.8
Alaska	6,576,659	22.3	0.1	6,674,197	18.5	0.1
Arizona	101,478,654	6.3	0.1	104,392,528	6.6	0.1
Arkansas	47,794,509	10.0	3.6	52,168,703	6.2	3.3
California	200,292,818	31.5	11.8	216,798,688	33.2	11.0
Colorado	49,616,694	4.4	1.6	50,698,353	5.3	1.8
Connecticut	33,549,747	3.6	2.3	34,681,736	3.8	2.2
Delaware	8,136,568	-	-	7,182,179	*	*
District of Columbia	226,042	-	-	81,467	-	-
Florida	220,256,412	2.1	2.0	223,751,621	2.1	2.0
Georgia	136,667,892	5.3	2.4	138,010,208	4.4	2.5
Hawaii	11,522,805	5.5	4.7	11,559,174	6.4	5.3
Idaho	10,824,984	84.2	5.3	13,386,085	89.2	5.2
Illinois	194,120,146	0.4	0.4	192,426,958	0.5	0.4
Indiana	130,371,573	0.3	0.1	130,489,788	0.5	0.2
Iowa	44,156,160	6.1	4.0	45,483,462	7.4	5.4
Kansas	45,862,696	0.9	0.9	45,523,736	2.2	2.2
Kentucky	97,822,419	3.4	0.4	98,792,014	3.1	0.5
Louisiana	92,616,878	3.8	2.9	90,921,829	4.1	3.3
Maine	18,843,978	43.3	21.6	16,816,173	49.1	23.6
Maryland	52,661,600	4.4	1.2	48,956,880	5.6	1.3
Massachusetts	47,515,443	4.8	2.7	45,597,775	6.1	2.8
Michigan	121,619,771	3.2	2.1	112,556,738	3.5	2.2
Minnesota	53,018,995	6.4	5.0	53,237,789	6.8	5.7
Mississippi	45,067,453	3.3	3.4	46,228,847	3.3	3.3
Missouri	90,828,230	1.2	*	91,686,343	0.2	*
Montana	27,938,778	34.5	0.2	28,243,536	37.7	1.9
Nebraska	31,464,734	3.2	0.4	31,669,969	3.8	1.0
Nevada	40,213,752	7.3	3.1	31,860,022	10.7	4.2
New Hampshire	24,470,013	11.2	3.9	22,063,695	10.3	3.4
New Jersey	60,549,583	1.5	1.4	60,700,139	1.6	1.5
New Mexico	35,135,642	2.7	2.3	37,265,625	4.0	3.4
New York	146,887,419	18.9	1.4	142,265,432	21.1	1.8
North Carolina	129,748,578	5.5	1.4	125,214,784	4.5	1.5
North Dakota	31,932,615	4.9	0.7	30,881,137	6.1	1.2
Ohio	156,976,323	0.5	0.3	155,434,075	0.7	0.3
Oklahoma	68,607,827	5.4	1.7	70,614,880	3.7	2.9
Oregon	49,325,003	66.0	3.3	53,340,695	74.5	3.5
Pennsylvania	218,091,125	2.0	1.1	218,811,595	2.4	1.1
Rhode Island	6,053,294	0.1	*	5,967,725	2.6	2.5
South Carolina	102,514,665	4.6	1.7	99,267,606	3.7	1.9
South Dakota	6,520,769	49.5	2.4	7,132,243	49.7	2.1
Tennessee	97,117,165	10.1	0.6	93,911,102	8.8	0.6
Texas	396,668,722	1.6	1.3	400,582,878	2.1	2.0
Utah	38,165,131	2.5	0.5	41,263,324	2.3	0.5
Vermont	5,716,755	28.5	7.4	7,084,344	27.8	6.4
Virginia	78,943,045	5.0	3.2	73,069,537	5.3	3.4
Washington	101,965,850	72.7	2.1	108,203,155	78.1	2.3
West Virginia	93,626,285	1.7	0.2	93,815,804	1.9	0.2
Wisconsin	61,824,664	4.9	2.1	61,639,843	4.9	2.2
Wyoming	45,567,307	3.3	1.6	45,400,370	3.5	1.7
Total	**4,055,422,750**	**8.8**	**2.2**	**4,064,702,227**	**9.5**	**2.4**

* = Less than .05 percent.
\- = Not applicable.

Note: Revisions to biomass capacity removed tires from renewable waste energy. Dash indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Source: EIA.

plant are both examples of the steps and costs associated with the decommissioning process.

RENEWABLE ENERGY

Often called "clean" or "green" energy, renewable energy is energy from natural resources, such as wind, plants, sunlight, rain, tides, and heat from the earth. The resources for renewable energy are not depleted with use or are replenished in a short amount of time, as opposed to other sources of energy, such as coal or natural gas. Examples of renewable energy include biomass, geothermal, wind, and solar.

Biomass energy is derived from non-fossilized material from plants, such as wood and wood waste, which are the largest sources of biomass energy. Biomass energy accounts for 47% of all renewable energy consumption in the U.S. and is the only form of renewable energy that is used more for non-electric purposes than to generate electricity.[95] Supplies of biomass energy are limited by their distance from the generator; a distance of more than 50 miles increases costs.[96]

Municipal solid waste and alcohol biofuels are the next largest sources of biomass energy. Biofuels are liquid fuels produced from plants, such as ethanol, primarily derived from corn, and biodiesel, made by processing vegetable oil, cooking grease, or animal fats, with other chemicals.

Water is the most common and least expensive renewable energy resource. Hydropower energy generates electricity from flowing water; the amount that is produced depends on the amount of precipitation in any given year. Hydropower dams produced 7% of electricity generated in the U.S. in 2004, accounting for 45% of total renewable energy consumption.[97] While the availability of hydropower electricity fluctuates with rainfall, new technologies are being developed to harness the energy from ocean currents, tides, and waves.

Wind energy is energy harvested from wind turbines, which are modern versions of the windmill. Wind power is the fastest growing energy technology in the world. In the U.S., wind power experienced an annual average rate increase of 28% between 2001 and 2005. Wind currently represents 3% of total renewable energy use in the U.S. and accounts for 5% of renewable energy sources consumed by the electric power sector.[98]

Solar energy is created from the collection and conversion of sunlight into heat and electricity. While using energy from the sun dates back to ancient times, converting sunlight into electricity is a relatively new technology that has been developed in the last 50 years. Ninety percent of solar energy is used to produce heat and the remaining energy is used for electricity.[99]

Geothermal energy comes from natural sources within the earth. By drilling into the earth's surface, heated steam or water rises to the surface and powers steam turbines and electrical generators. Geothermal energy is used primarily for electricity and accounts for 6% of total renewable energy consumption in the U.S.[100] Geothermal power plants are found in Utah, California, Hawaii and Nevada.[101]

The U.S. has vast amounts of renewable resources available. It is estimated that over 25% of U.S. land areas have winds strong enough to generate electricity at market-competitive prices. States in the Southwest have the potential to generate electricity through solar power at 10 times the rate of the current U.S. total generating capacity today from all sources. Parts of the Pacific Northwest have vast hydropower resources.[102]

Figure 23: U.S. Energy Consumption by Energy Source, 2002-2006
Quadrillion Btu

Energy Source	2002	2003	2004	2005	2006
Total [a]	97.684	97.971	100.051	100.161	99.398
Fossil Fuels	83.994	84.386	86.191	86.451	85.307
Coal	21.904	22.321	22.466	22.795	22.452
Coal Coke Net Imports	0.061	0.051	0.138	0.044	0.061
Natural Gas [b]	23.558	22.897	22.931	22.583	22.190
Petroleum [c]	38.227	38.809	40.294	40.393	39.958
Electricity Net Imports	0.072	0.022	0.039	0.084	0.063
Nuclear Electric Power	8.143	7.959	8.222	8.160	8.214
Renewable Energy	5.893	6.150	6.261	6.444	6.922
Biomass [d]	2.706	2.817	3.023	3.154	3.374
Biofuels	0.309	0.414	0.513	0.595	0.795
Waste	0.402	0.401	0.389	0.403	0.407
Wood Derived Fuels	1.995	2.002	2.121	2.156	2.172
Geothermal Energy	0.328	0.331	0.341	0.343	0.343
Hydroelectric Conventional	2.689	2.825	2.690	2.703	2.869
Solar/PV Energy	0.064	0.064	0.065	0.066	0.072
Wind Energy	0.105	0.115	0.142	0.178	0.264

[a] Ethanol blended into motor gasoline is included in both "Petroleum" and "Biomass," but is counted only once in total consumption.
[b] Includes supplemental gaseous fuels.
[c] Petroleum products supplied, including natural gas plant liquids and crude oil burned as fuel.
[d] Biomass includes: biofuels, waste (landfill gas, MSW biogenic, and other biomass), wood and wood derived fuels. MSW=Municipal Solid Waste.

Source: EIA.

The availability of renewable energy sources varies by state, and within each state, exploitation of renewable energy resources varies widely. As illustrated in Figure 22, 89.2% of Idaho's electricity is from renewable sources, followed by Washington at 78.1%, and Oregon at 74.5%. All three states receive the bulk of their electricity from renewable hydropower sources. Outside of the Pacific Northwest, Maine and South Dakota have the next highest reliance on renewable resources for electrical generation, at 49.7% and 49.1% respectively.

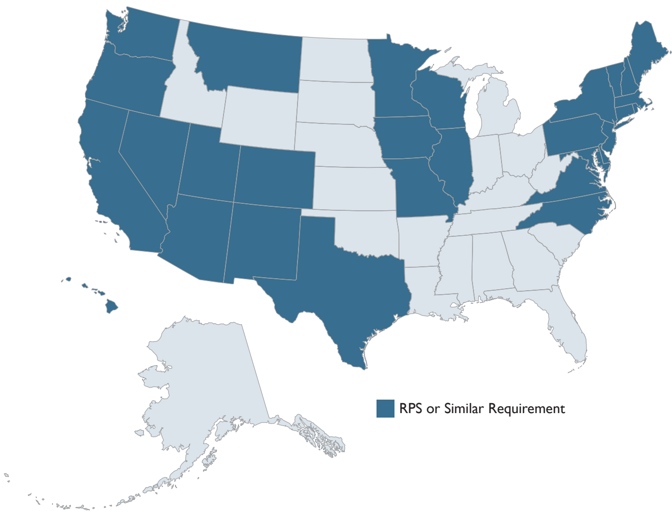
Utah has several facilities for renewable energy. At the end of 2007, there were 2 biomass facilities, 1 active geothermal facility, 31 solar facilities, 3 wind facilities and 63 hydropower facilities.[103] Only a small portion of Utah's energy comes from renewable resources; in 2006, only 2.3% of Utah's electrical generation was from renewable sources.

Renewable Energy Supply and Demand

Figure 23 illustrates U.S. energy consumption by source. Fossil fuels, such as coal and natural gas, are the major sources of energy in the U.S.; only 7% of total energy consumption in the U.S. is from renewable energy sources. The electric power sector and industrial sectors have the largest demand for renewable energy. In 2004, 70% of all renewable energy was used for electrical generation.[104] Additional uses for renewable energy include the heating and cooling of buildings and homes, as well as generating heat for industrial uses, which together accounted for 25% of total renewable energy use in 2004.[105] The remainder of renewable energy was used for transportation fuels.[106]

Demand for renewable energy will continue to rise as more states enact Renewable Portfolio Standards (RPSs). An RPS is a state policy mandating that a certain percent of the state's electricity come from renewable sources by a certain date. By April 2008, 25 states and the District of Columbia had enacted RPSs, and 4 states—Utah,

Figure 24: States With Renewal Portfolio Standards (RPSs) and Goals, as of April 2008



Note: Four of these states have adopted non-binding goals, rather than RPS: Utah, Missouri, Virginia, and Vermont.
Source: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE).

Missouri, Virginia, and Vermont—had non-binding goals, which are voluntary goals for adopting renewable energy as opposed to portfolio standards with binding targets. Each state varies in the amount of electricity it requires to come from renewable resources; current RPS requirements range from 4% to 25%.[107] The compliance dates range from 2009 to 2025. The benefits of RPSs include environmental protection from pollutants, waste reductions, habitat protection, conservation of non-renewable resources, and economic benefits, such as increased diversity and security of energy resources, as well as reduced energy price volatility, which is achieved by stabilizing the costs of renewable energy.

Figure 24 illustrates the states that have enacted RPSs. In March 2008, Governor Huntsman signed the Energy Resource and Carbon Emission Reduction Initiative. The bill states that beginning in 2025, 20% of the adjusted sales from electrical corporations and municipal utilities must come from renewable sources, if cost effective.[108] The bill contains many similar provisions that are found in other states' mandates. However, analysis by the Database for State Incentives for Renewables and Efficiency (DSIRE) considers this bill to be more of a Renewable Portfolio *Goal,* rather than a standard, because it states that renewable energy must comprise 20% of adjusted electricity sales only if such energy is *cost-effective*. Also, there are no interim renewable goals before the enactment of the bill in 2025.[109]

The growing demand for renewable energy is evident in the rise of "green" pricing programs. Many electric power suppliers allow customers to pay extra to have their energy provided by a renewable energy source. The number of "green" pricing program participants has been increasing recently and grew by 9.2% between 2004 and 2005 in the U.S.[110] The majority of green pricing customers in the U.S. are residential consumers. Ohio has the highest number of green pricing customers, with more than double the number of green pricing customers as the next highest state, Texas.[111]

Rocky Mountain's (Utah Power) Blue Sky program is an example of a green pricing program available in Utah that allows customers the option of having a portion of their energy come from wind power. Ranking in the top five green pricing programs by the National Renewable Energy Laboratory for the number of customers who purchase renewable energy, the Blue Sky Program allows customers to purchase a block of 100 kilowatt hours of renewable energy for $1.95 per month.[112]

The Future of Renewable Energy in Utah

While renewable energy resources in and of themselves are free and non-polluting, there are several barriers to using renewable energy that must be addressed, such as the reliability of renewable energy and the costs associated with collecting, harnessing, storing, and transporting renewable energy power. As a result of these issues, the cost of renewable energy can be high when compared to other sources of energy.

Additionally, the infrastructure that must be built to gather renewable energy—windmills or dams, for example—can have negative impacts on the landscape and wildlife habitats where they are located. There has also been opposition to the development of renewable energy projects on sacred Native American lands.

Despite these concerns, the demand for renewable energy is expected to continue to rise, as the public increases its awareness of diminishing fossil fuel supplies and environmental issues, such as climate change and air pollution. Worldwide, in 2007, more than $100 billion dollars were invested in new renewable energy capacities, including power plants and research and development.[113] Domestically, there are numerous federal and state tax incentives and deductions, as well as grants and loan programs that encourage the production and use of renewable and energy-efficient resources and technologies.

CONCLUSION

Looking at the overall picture of the state's energy economy, it is clear that Utah enjoys some distinct advantages when compared to the rest of the nation. In terms of energy resources, Utah consumes mostly oil, coal, and natural gas in the forms of motor fuel, electricity, and heat. Utah produces more coal and natural gas than it consumes and is therefore a net exporter of these products.

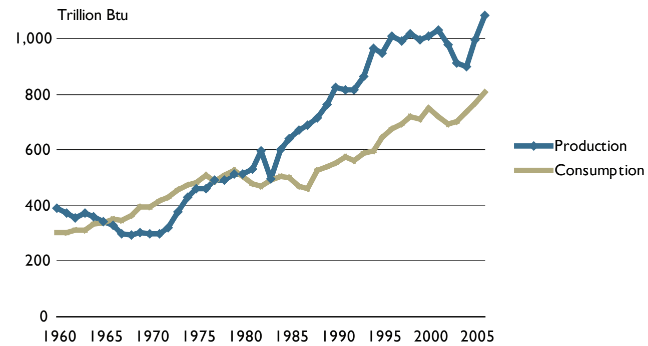
Utah is also a net exporter of electricity, due, in large part, to its large amount of coal production and the fact that the vast majority of Utah's electricity is produced from coal-fired power plants (see Figure 25). This dynamic is also true of Utah's overall energy production and consumption (see Figure 26).

Figure 25: Utah Electricity Generation and Sales, December 2006

	GWh	% of Utah Total
Total Net Electricity Generation	**3,765**	**100.0%**
Petroleum-Fired	4	0.1%
Natural Gas-Fired	472	12.5%
Coal-Fired	3,213	85.3%
Nuclear	—	0.0%
Hydroelectric	56	1.5%
Other Renewables	19	0.5%
Electricity Sales	**2,434**	**100.0%**
Residential	761	31.3%
Commercial	801	32.9%
Industrial	869	35.7%
Transport	3	0.1%

Source: EIA.

Figure 26: Utah Energy Balance, Production and Consumption



Source: Utah Geological Survey.

In the case of oil, Utah is a net importer. However, Utah does produce a portion of its petroleum consumption, which is an advantage, especially compared to states that import all of their oil. Furthermore, Utah has a relatively isolated energy market; this is because of the state's geographic isolation and the cost of transporting or transmitting energy over long distances. The relative independence of Utah's energy market could tend to make it less susceptible to market fluctuations nationwide.

Together, these supply, production, consumption, and other market factors will maintain a favorable energy situation for Utah in the near future. In the short term, Utah will likely continue to have very competitive energy prices compared to the rest of the country.

In the long run, however, there are several potential threats to Utah's favorable energy market. While prices for most energy sources in Utah will probably remain lower than the rest of the country, they will continue to rise, in absolute terms, due to increasing domestic and global demand, which is fueled by a growing national and global population and increased per capita consumption. These demand shifts will be accompanied by an increase in energy consumption in Utah due to the growing in-state population, which is projected to be quite rapid over the next 20-30 years.

In the medium term, Utah will be forced to confront the fact that fossil fuels are an inherently diminishing resource because fuel supplies are finite. While new reserves may be discovered and producer and consumer efficiencies in energy consumption may increase, the availability of Utah's most relied-upon energy resources—oil, coal, and natural gas, all of which are fossil fuels—is limited.

As was mentioned earlier in the report, worldwide oil reserves could start drying up in as soon as 50 years, with coal following 50-100 years behind, and natural gas sometime after that. If overall consumption increases worldwide and if per capita energy use increases significantly, estimates are even shorter.

Diminishing supplies of fossil fuels will likely lead to further price increases and, eventually, scarcity of fossil fuel-based energy, like gasoline and coal-powered electricity. In the medium term, oil substitutes, such as oil shale and tar sands, could prolong the availability of the supplies of oil, coal, etc., and keep prices somewhat lower and resources in better supply than they would have been in the absence of such substitutes.

In the long term, 50-100 years from now, fossil fuels will start to run out. This could either result in serious consequences for those societies built predominantly on fossil fuels, or in the innovation of new methods for powering the high standard of living that Utahns enjoy. While oil substitutes are an attractive medium term solution, they are still subject to diminishing supplies. Renewable and nuclear energies are the currently known sources of energy that are not subject to the same diminishing supplies as fossil fuels. While in the short run they will be more expensive and less efficient to adopt, they remain a consistently viable source of energy into the distant future.

Policy aimed at maintaining a favorable energy situation for Utah, including low prices and good supplies, will address the short, medium, and long term issues related to Utah's energy production and use. A strategic view of energy by policymakers is necessary to ensure that Utah has and maintains the quality of life Utahns expect.

For additional information on the topics covered in this report, please refer to the following sources:

Power Producers in Utah

- American Coalition for Clean Coal http://www.cleancoalusa.org/
- American Petroleum Institute (API) http://www.api.org/
- Big West Oil Co. http://www.bigwestoil.com/
- Chevron USA Inc. http://www.chevron.com/
- Holly Corporation Refining and Marketing http://www.hollycorp.com/refineries_woods.cfm
- Independent Petroleum Association of Mountain States http://www.ipams.org/resources/industry.php
- Intermountain Power Agency http://www.ipautah.com/
- Questar http://www.questar.com/
- Rocky Mountain Coal Mining Institute http://www.rmcmi.org/index.cfm/ID/1/Home/
- Rocky Mountain Gas Association http://www.utrmga.org/index.html
- Rocky Mountain Power (PacifiCorp) http://www.rockymtnpower.net
- Silver Eagle Refining http://www.silvereaglerefining.com/
- Tesoro West Coast http://www.tsocorp.com/TSOCORP/index.htm
- Utah Petroleum Association http://www.utahpetroleum.org/index.html

Government Departments, Agencies & Groups

- Governor's Energy Policy http://energy.utah.gov/energy/governors_priorities
- Governor's Energy Advisor http://www.energy.utah.gov/energy/energy_advisor.html
- Utah Department of Transportation http://www.udot.utah.gov/main/f?p=100:1:5162046515915074698::NO::T,V:1%2C
- Utah Department of Natural Resources http://www.nr.utah.gov/
- Utah Division of Oil, Gas and Mining http://www.ogm.utah.gov/
- Utah Department of Environmental Quality http://www.deq.utah.gov/
- Utah Division of Air Quality http://www.airquality.utah.gov/
- Utah Division of Public Utilities http://www.publicutilities.utah.gov/
- National Tribal Environmental Council http://www.ntec.org/
- Rocky Mountain Clean Diesel Collaborative http://www.epa.gov/region8/air/rmcdc.html
- State of Utah School and Institutional Trust Lands Administration http://trustlands.utah.gov/
- United States Census Bureau http://www.census.gov.
- United States Senate Environmental and Public Works http://epw.senate.gov/public/
- Utah Geological Survey http://geology.utah.gov
- Wasatch Front Regional Council http://www.wfrc.org/
- Western Air Regional Partnership http://www.wrapair.org/
- Western Governor's Association http://www.westgov.org/index.htm
- Utah Division of Public Utilities http://publicutilities.utah.gov/
- Public Service Commission (PSC) http://www.psc.state.ut.us/
- EPA's Region VIII office http://www.epa.gov/region8/
- Rocky Mountain Clean Diesel Collaborative (RMCDC) http://www.epa.gov/region8/air/rmcdc.html#goals
- Western States Air Resource Council (WESTAR) http://www.westar.org/
- U.S. Department of Energy (DOE), Energy Efficiency and Renewable Energy (EERE) http://www.eere.energy.gov/
- U.S. Department of the Interior (Bureau of Land Management) http://web.ead.anl.gov/dwm/regs/federal/blm/index.cfm
- U.S. Forest Service http://www.fs.fed.us/
- Federal Energy Regulatory Commission (FERC) http://www.ferc.gov/
- U.S. Nuclear Regulatory Commission http://www.nrc.gov/
- House Committee on Energy and Commerce http://energycommerce.house.gov/
- House Committee on Natural Resources http://resourcescommittee.house.gov/

Energy Advocacy Groups

Producers

- Utah Petroleum Association http://www.utahpetroleum.org/index.html
- Independent Petroleum Association of Mountain States (IPAMS) http://www.ipams.org/resources/industry.php
- American Coalition for Clean Coal Electricity http://www.cleancoalusa.org/
- Rocky Mountain Coal Mining Institute http://www.rmcmi.org/index.cfm/ID/1/Home/
- Rocky Mountain Gas Association/Utah Heating & Air Conditioning Contractors Association (RMGA/UHACCA) http://www.utrmga.org/index.html
- American Petroleum Institute (API) http://www.api.org/
- Utah Mining Association http://www.utahmining.org/

Consumers

- Utah Ratepayers' Association http://utahratepayers.org/
- Crossroads Urban Center http://www.crossroads-u-c.org/
- Utah Committee of Consumer Services (CCS) http://ccs.utah.gov/index.html
- Utah Legislature Watch http://www.crossroads-u-c.org/

Environment

- Utah chapter of the Sierra Club http://utah.sierraclub.org/issues.asp
- Northwest Energy Coalition Staff http://www.nwenergy.org/
- NextGen Energy Council http://www.nextgenenergy.org/about+us.aspx
- Green Corps http://www.greencorps.org/about-us/history-and-mission
- American Wind Energy Association (AWEA) http://www.awea.org/smallwind/utah.html

- National Geothermal Collaborative (NGC) http://www.geocollaborative.org/index.htm
- Western Resource Advocates http://www.westernresources.org/
- Utah Clean Energy (UCE) http://www.utahcleanenergy.org/
- Utah Wind Power Campaign http://www.utahpower.net/Homepage/Homepage35892.html
- Utah Moms for Clean Air http://www.utahmomsforcleanair.org/about/
- Utah Physicians for a Healthy Environment http://www.uphe.org/
- LessCoal http://www.lesscoal.com/
- Citizens for Dixie's Future (CDF) http://citizensfordixie.org/component/option,com_frontpage/Itemid,48/
- Sevier Citizens for Clean Air & Water (SCCAW) http://seviercitizens.com/

Energy Resource Information

Petroleum

- Energy Information Administration. Official Energy Statistics from the U.S. Government http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html
- Utah Geological Survey http://geology.utah.gov/

Coal

- Energy Information Agency Official Statistics from the U.S. Government http://www.eia.doe.gov/fuelcoal.html
- FutureGen Alliance http://www.futuregenalliance.org/
- Governor's Energy Policy http://energy.utah.gov/energy/governors_priorities/coal.html
- International Energy Agency http://www.worldenergyoutlook.org
- United States Environmental Protection Agency http://www.epa.gov
- Utah Geological Survey. http://geology.utah.gov/

Natural Gas

- Energy Information Administration http://www.eia.doe.gov/oil_gas/natural_gas/info_glance/natural_gas.html

Nuclear

- Energy Information Administration http://www.eia.doe.gov/fuelnuclear.html
- Nuclear Energy Institute http://www.nei.org
- United States Department of Energy, Civilian Radioactive Waste Management http://www.ocrwm.doe.gov/

Renewable Energy

- Database for State Incentives for Renewables and Efficiency http://www.dsireusa.org
- Energy Information Administration http://www.eia.doe.gov/fuelrenewable.html
- Renewable Energy Atlas of the West http://www.energyatlas.org/
- Renewable Energy Policy Network for the 21st Century http://www.ren21.net
- World Watch Institute http://www.worldwatch.org/

ENDNOTES

1 Energy Information Administration. Official Statistics from the U.S. Government. "Energy Consumption Estimates by Source. Available from: http://www.eia.doe.gov/emeu/states/sep_sum/html/sum_btu_tot.html; A Btu describes the heat value (energy content) of a fuel. A Btu is a precise measurement of the energy required to raise the temperature of one pound of water one degree Fahrenheit. By converting quantities of fuel into this common measurement, cost comparisons are possible between fuels.

2 Carbon Footprint Ltd. Homepage. Available from: http://www.carbonfootprint.com/

3 Energy Information Administration. "Energy Consumption by Source and Total Consumption per Capita, Ranked by State, 2005." Available from http://www.eia.doe.gov/emeu/states/sep_sum/plain_html/rank_use_per_cap.html;Eredux.com "Utah Energy Consumption, Statistics and Maps." Available from: http://www.eredux.com/states/state_detail.php?id=1144

4 Energy Information Administration. "Energy Glossary." Available from: http://www.eia.doe.gov/glossary/index.html

5 Vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use

6 Energy Information Administration. "Energy Consumption by Source and Total Consumption per Capita, Ranked by State, 2005." Available from http://www.eia.doe.gov/emeu/states/sep_sum/plain_html/rank_use_per_cap.html

7 Energy Information Administration. "Energy Consumption Estimates by Source, 2005." Available from: http://www.eia.doe.gov/emeu/states/sep_sum/html/sum_btu_tot.html The United States average is 455.9 trillion Btu of coal annually.

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