Energy Information Report

December 2007

Submitted by the Iowa Office of Energy Independence

www.energy.iowa.gov

In its 2007 session, the 82nd Iowa General Assembly passed, and Governor Culver signed into law, extensive and far-reaching new state energy policy legislation. Included was a directive to the Department of Natural Resources (DNR) to deliver to the Director of the Office of Energy Independence a report on six broad topics regarding Iowa's energy resources. In particular, House File 918 amends Iowa Code 473.7(1) so that the DNR is to report on:

A. The historical use and distribution of energy in Iowa.
B. The growth rate of energy consumption in Iowa, including rates of growth for each energy source.
C. A projection of Iowa's energy needs at a minimum through the year 2025.
D. The impact of meeting Iowa's energy needs on the economy of the state, including the impact of energy efficiency and renewable energy on employment and economic development.
E. The impact of meeting Iowa's energy needs on the environment of the state, including the impact of energy production and use on greenhouse gas emissions.
F. An evaluation of renewable energy sources, including the current and future technological potential for such sources.

Much of the energy information for this report has been derived from the on-line resources of the Energy Information Administration (EIA) of the United States Department of Energy. The EIA provides policy-independent data, forecasts, and analyses on energy production, stored supplies, consumption, and prices. For complete, economy-wide information, the most recent data available from EIA is for 2004. For many energy sectors more current data is available from EIA and other sources, and that information has been included in this report.

A. Historical use and distribution of energy in Iowa.

Imported Energy

Iowa continues to rely heavily on energy imported from other states and nations. EIA data from 2004 indicated that 95.4% of Iowa's energy resources were imported, Table 1. This is down slightly from 96.2% in 2000. The slight downward trend between 2000 and 2004 is due to increased use of ethanol and wind energy. However, use of imported energy in 2004 was higher than in 1980 and 1990, mainly due to decreased use of biomass resources.

Table 1: Iowa Energy Imports

Year	Percent of Total Energy Consumed *
1980	95.2%
1990	94.7%
2000	96.2%
2001	96.2%
2002	95.6%
2003	95.4%
2004	95.4%

Note:

- The Imported Energy Total excludes “Biomass,” “Ethanol” and “Other”.
- “Biomass” includes energy from wood and other plant and animal waste.
- “Other” includes, wind, solar and geothermal energy.

Energy Mix

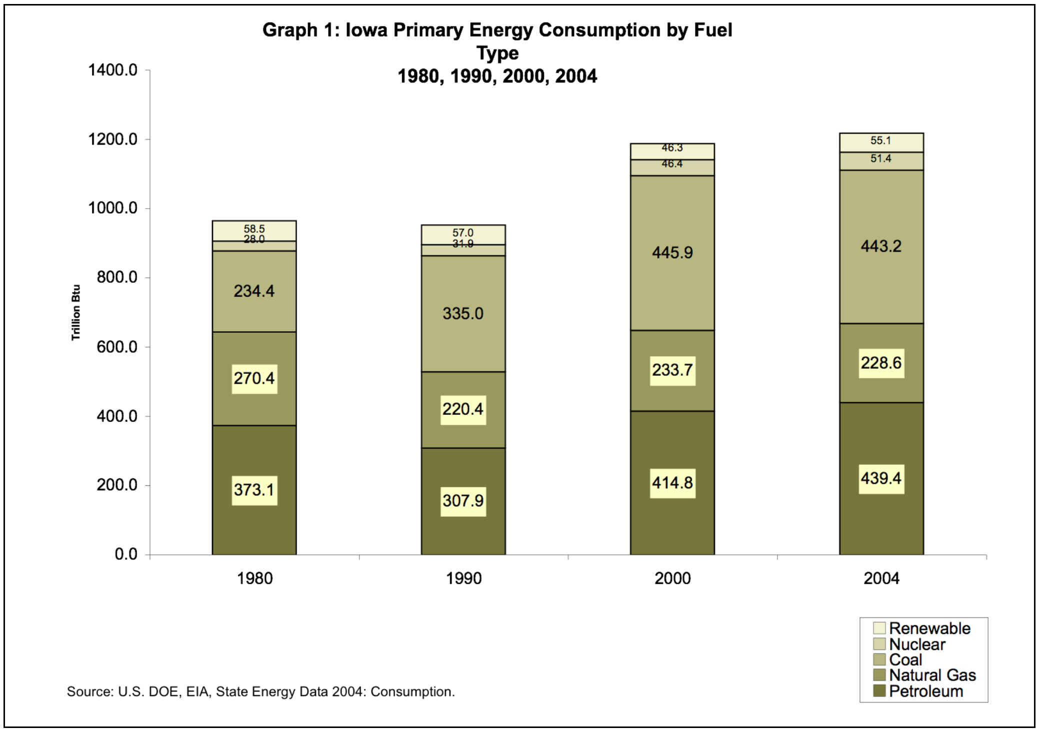
As a percent of total energy consumption in Iowa in 2004 (Table 2) coal use was 36.8%, petroleum 36.1%, and natural gas 18.8%. Nuclear energy comprised 4.2% of the total and renewable energy (hydro, solar, wind, ethanol and biomass) represented 4.5%. Comparison of Iowa's energy use to the overall U.S. energy use is included in Table 2. Of particular note is the fact that coal comprises a significantly larger portion of the total energy used in Iowa than in the nation as a whole.

Table 2: Proportions of Energy Resources Used - 2004

Fuel	Iowa	United States
Coal	36.8%	22.5%
Petroleum	36.1%	40.2%
Natural Gas	18.8%	22.9%
Nuclear	4.2%	8.2%
Renewable Energy*	4.5%	6.2%

* Renewable Energy includes hydro, geothermal, solar, wind and biomass.

Graphs 1 and 2, and Table 3 show changes in Iowa's energy consumption mix between 1980, 1990, 2000 and 2004. There are several noteworthy trends. Between 1980 and 2000, use of coal increased substantially and it continues to be the most used energy source in Iowa. The proportion of natural gas use has declined steadily since 1980. Petroleum use declined significantly between 1980 and 1990, but has again increased since 1990. Use of nuclear energy in Iowa has continued to increase steadily since 1980. Renewable energy use dropped between 1980 and 2000, mainly due to decreased use of biomass resources. The growth in renewable energy use between 2000 and 2004 has been caused by increased use of ethanol and wind energy.


Graph 1: Iowa Primary Energy Consumption by Fuel Type
1980, 1990, 2000, 2004
Trillion Btu
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
1980
1990
2000
2004
58.5
28.0
234.4
270.4
373.1
57.0
31.9
335.0
220.4
307.9
46.3
46.4
445.9
233.7
414.8
55.1
51.4
443.2
228.6
439.4
Renewable
Nuclear
Coal
Natural Gas
Petroleum
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption.

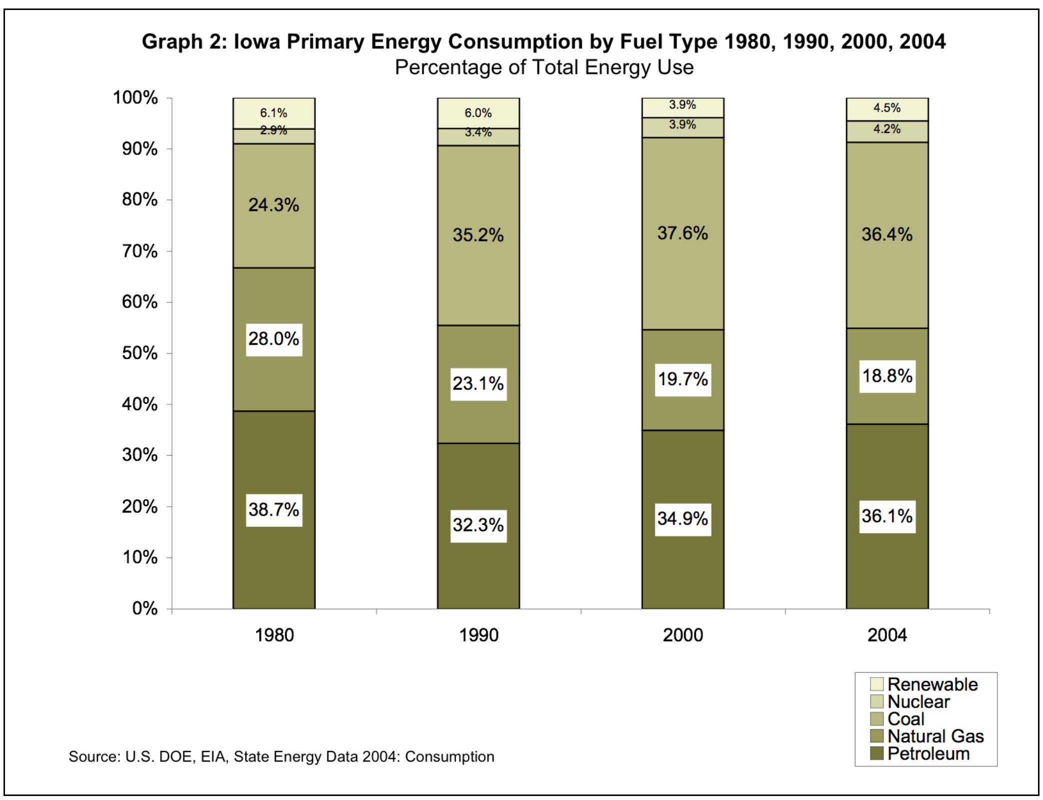

Graph 2: Iowa Primary Energy Consumption by Fuel Type 1980, 1990, 2000, 2004
Percentage of Total Energy Use
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1980
1990
2000
2004
6.1%
2.9%
24.3%
28.0%
38.7%
6.0%
3.4%
35.2%
23.1%
32.3%
3.9%
3.9%
37.6%
19.7%
34.9%
4.5%
4.2%
36.4%
18.8%
36.1%
Renewable
Nuclear
Coal
Natural Gas
Petroleum
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Table 3: Iowa Primary Energy Consumption Changes 1980-2004

Fuel	1980-1990 Percentage change	1990-2000 Percentage change	2000-2004 Percentage change	1980-2004 Percentage change
Petroleum	-17.5%	34.7%	5.9%	17.8%
Natural gas	-18.5%	6.0%	-2.2%	-15.5%
Coal	42.9%	33.1%	-0.6%	89.1%
Nuclear	13.9%	45.5%	10.8%	83.6%
Renewable	-2.6%	-18.8%	19.0%	-5.8%

Economic Sectors

As seen in Table 4 below, the Industrial Sector, which includes agricultural activities, is the largest user of energy in Iowa, accounting for 41.1% of all energy consumed in 2004. The next highest energy-using sector is Transportation with a 24.6% share. The Residential Sector accounted for 19.1%, and the Commercial Sector used 15.1% of all energy consumed in Iowa in 2004.

The most significant trend over the years has been the steady decline of the residential energy consumption as a percentage of total energy consumption. Between 1980 and 2004, the portion of residential energy use dropped from 23.9% to 19.1% of total energy use. Over the same time period, actual energy use by the residential sector dropped by 4.5%. All other sectors saw growth in energy use between 1980 and 2004. Fastest energy use growth occurred in the commercial sector at 45.0%. Industrial energy use grew by 23.3% and transportation sector 24.8% between 1980 and 2004.

Table 4: Changes in Iowa Energy Usage by Economic Sector

Sector	1980		1990		2000		2004	
	Trillion Btu	Percent	Trillion Btu	Percent	Trillio Btu	Percent	Trillion Btu	Percent
Residential	241.2	23.9%	214.4	22.2%	236.5	20.1%	230.4	19.1%
Commercial	125.7	12.5%	141.1	14.6%	173.3	14.7%	182.3	15.1%
Industrial	402.2	39.9%	374.7	38.8%	497.1	42.2%	496.0	41.1%
Transportation	238.0	23.6%	235.8	24.4%	271.3	23.0%	297.1	24.6%
Total	1,007.1		966.0		1,178.1		1,205.8	

Table 5 details changes in the total primary energy consumption and residential energy consumption per person in the United States and Iowa. While the per person total energy use in the United States dropped by 0.9% between 1980 and 2004, per person total energy use grew by approximately 19% in Iowa during the same time period. However, per person residential energy consumption declined by 4.9% in Iowa between 1980 and 2004, while the U.S. residential consumption per person increased by 2.9% during that time.

Table 5: U.S. and Iowa Total Primary Energy and Residential Energy Consumption per Capita

Year	Total Primary Energy Consumption per Capita (Mbtu/capita)		Residential Energy Consumption per Capita (Mbtu/capita)	
	U.S.	Iowa	U.S.	Iowa
1980	345	344	70	82
1990	340	348	68	77
2000	352	404	73	81
2004	342	408	72	78

Electric Power Sector

The electric power sector is an important part of Iowa's energy profile. As seen in Table 6, a rapidly increasing percentage of Iowa's total energy use is being consumed by the electric power sector. In 1980, 24.5% of Iowa's total energy use was consumed by the electric power sector. By 2004 that percentage had climbed to 38.3%. Between 1980 and 2004, actual energy consumption in the electric power sector increased by 87.4%. By comparison, total energy use in Iowa grew by 19.7% during the same time period.

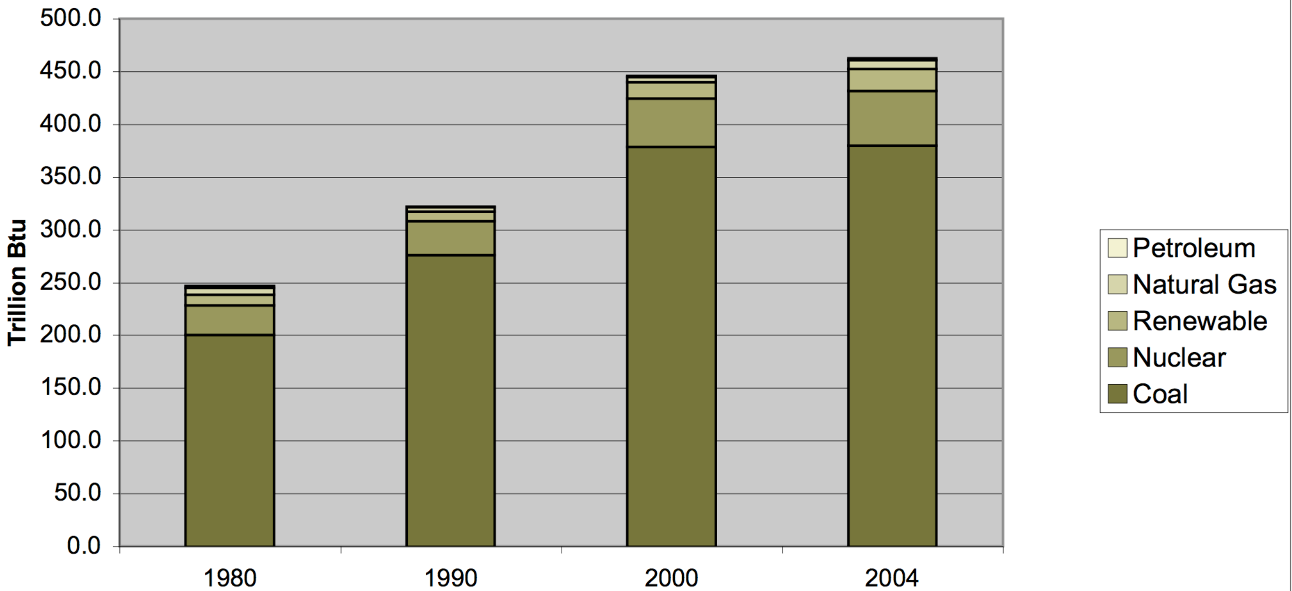
Table 6: Changes in Electric Power Sector Consumption in Iowa

Year	Total Energy Consumption (Trillion Btu)	Electric Sector Energy Consumption (Trillion Btu)	Electric Sector Consumption – Percentage of Total
1980	1,007.1	246.6	24.5%
1990	966.0	322.0	33.3%
2000	1,178.2	445.8	37.8%
2004	1,205.8	462.2	38.3%

Graph 3 and Tables 7 and 8 below detail electric utility input and generation capacity by fuel type in Iowa. Use of coal in electric generation increased sharply – by 88.9% – between 1980 and 2000. Between 2000 and 2004, use of coal leveled off and the percentage of coal use in electric generation slightly declined. Since 2000, there has been noticeable growth in use of renewable energy and natural gas in electric generation. The growth in renewable energy is due to rapid growth in wind energy capacity.

In 2006, coal-fired generation comprised 54.7% of Iowa's electric generation capacity but produced 75.6% of the state's net generation. This is due to the fact that coal generating plants are used for baseload generation. It is also noteworthy that between 1990 and 2006, coal generation capacity remained practically unchanged, increasing only by 5 megawatts. At the same time, coal-fired electric generation grew by 34%. Regarding Iowa's coal-fired generating capacity, MidAmerican Energy placing in service a 790 megawatt new coal plant in Council Bluffs in June 2007 was a significant recent development not reflected in the 2006 data. Generating units using natural gas and petroleum accounted for 30.5% of Iowa's electric capacity in 2005, but only provided 5.8% of net electric generation. This is explained by the fact that neither natural gas nor petroleum generators are used as baseload generating units.

Graph 3: Electric Utility Input in Iowa by Fuel Type
1980, 1990, 2000, 2004



Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Table 7: Operable Electric Capacity in Iowa by Fuel Type – 1990, 2006

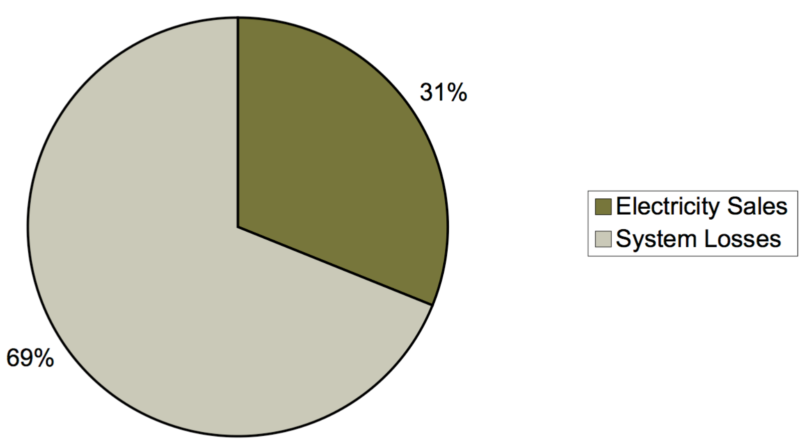
Fuel	1990 Capacity (MW)	1990 Percentage	2006 Capacity (MW)	2006 Percentage
Coal	6,092	73.4%	6,097	54.7%
Petroleum	714	8.6%	1,027	9.2%
Natural Gas	840	10.1%	2,371	21.3%
Nuclear	530	6.4%	581	5.2%
Hydro	130	1.6%	131	1.2%
Other Renewables	-	-	936	8.4%
Total	8,306		11,143	

Table 8: Electric Net Generation in Iowa by Fuel Type – 1990, 2006

Fuel	1990 Generation (MWh)	1990 Percentage	2006 Generation (MWh)	2006 Percentage
Coal	25,751,941	85.7%	34,4-5,293	75.6%
Petroleum	54,471	0.2%	208,285	0.5%
Natural Gas	333,390	1.1%	2,399,949	5.3%
Nuclear	3,011,572	10.0%	5,095,442	11.2%
Hydro	875,114	2.9%	909,348	2.0%
Other Renewables	18,018	0.1%	2,454,720	5.4%
Total	30,044,506		45,483,462	

Graph 4 illustrates the proportion of energy losses in the electric power sector. In 2004, 69% of energy inputs were lost in the generation, transmission, and distribution of electricity. Waste heat in electric generation comprises a large portion of these losses.

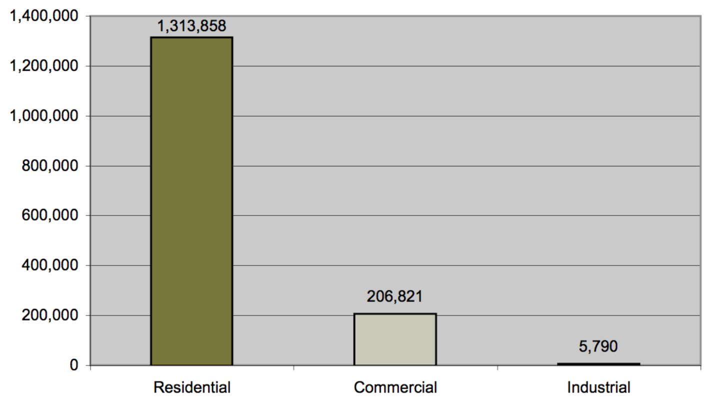
Graph 4: Retail Electricity Sales and System Losses in Iowa in 2004



Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

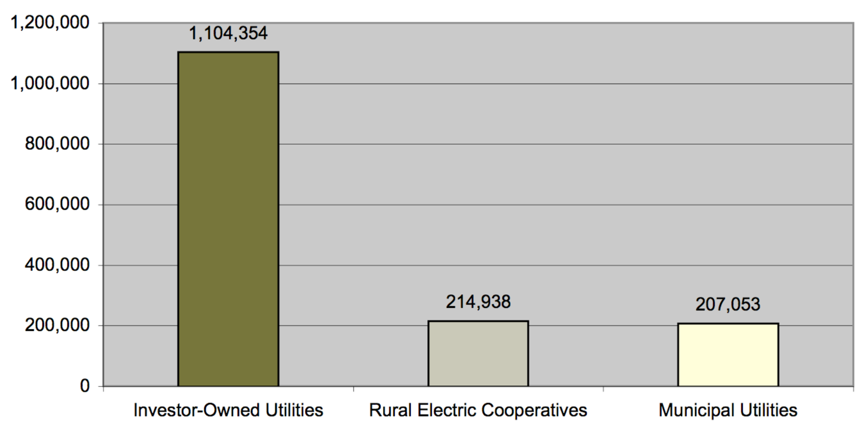
Graphs 5, 6 and 7 illustrate the structure of Iowa's electric power sector. Graph 5 indicates the number of electric end users by customer class and Graph 6 includes the breakdown of Iowa electric end users by utility type. In 2006, 72.4% of Iowa's electric customers were served by investor-owned utilities, 14.1% by rural electric cooperatives, and 13.6% by municipal utilities. Graph 7 includes electric service territories in Iowa.

Graph 5: Number of Electricity End Users in Iowa by Customer Class 2005



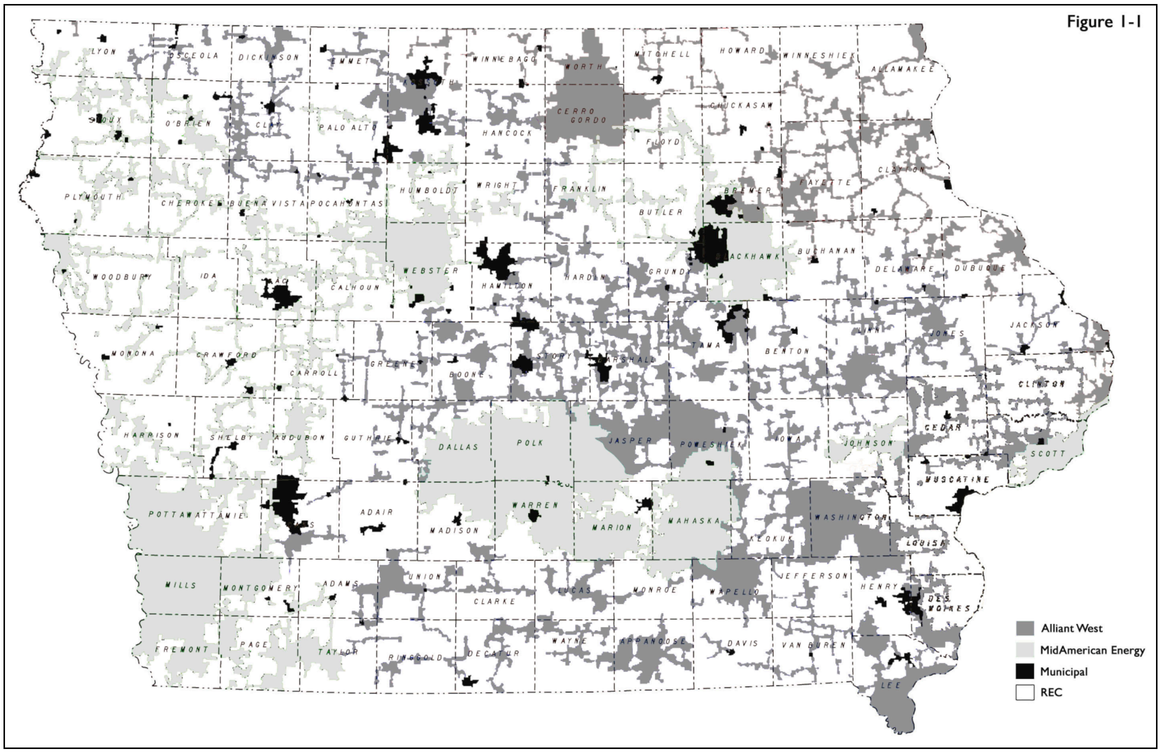
Source: U.S. DOE, EIA, Iowa Electricity Profile 2006

Graph 6: Number of Iowa Electricity Retail Customers by Utility Type 2006



Source: U.S. DOE, EIA, Iowa Electricity Profile 2006

Graph 7: Iowa Electric Utility Service Territories

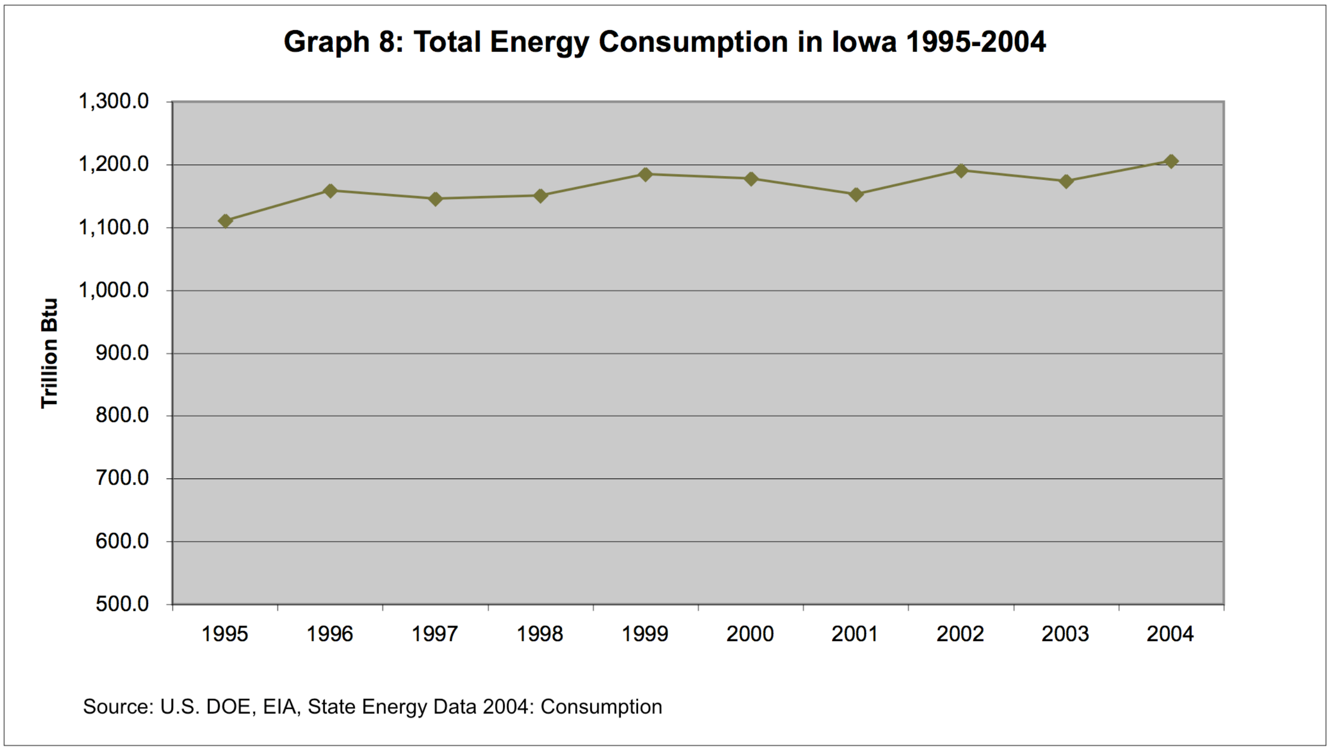


Source: Iowa Utilities Board

B. Growth rate of energy consumption in Iowa, including rates of growth for each energy source.

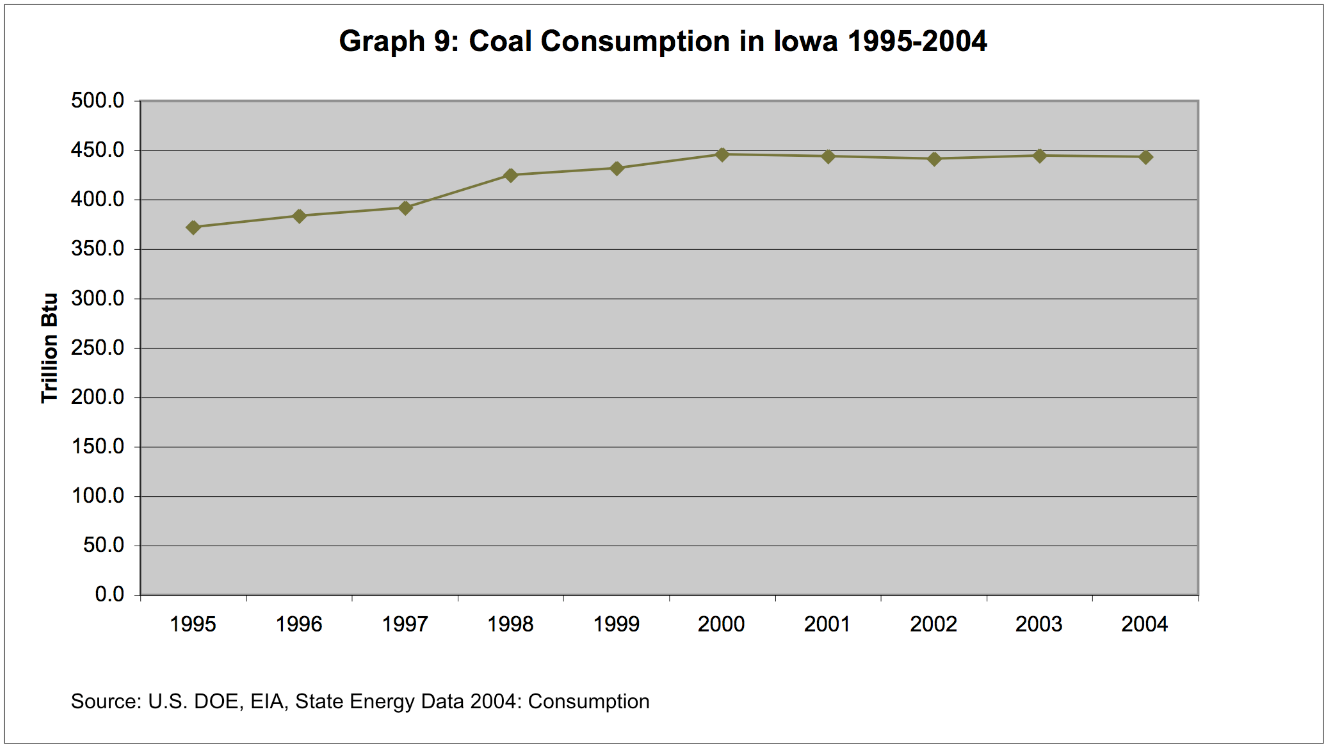
Total Energy Consumption

Iowa's 2004 total energy consumption was 1,206 Trillion BTUs, which is 8.6% higher than the 1,111 BTUs in 1995.



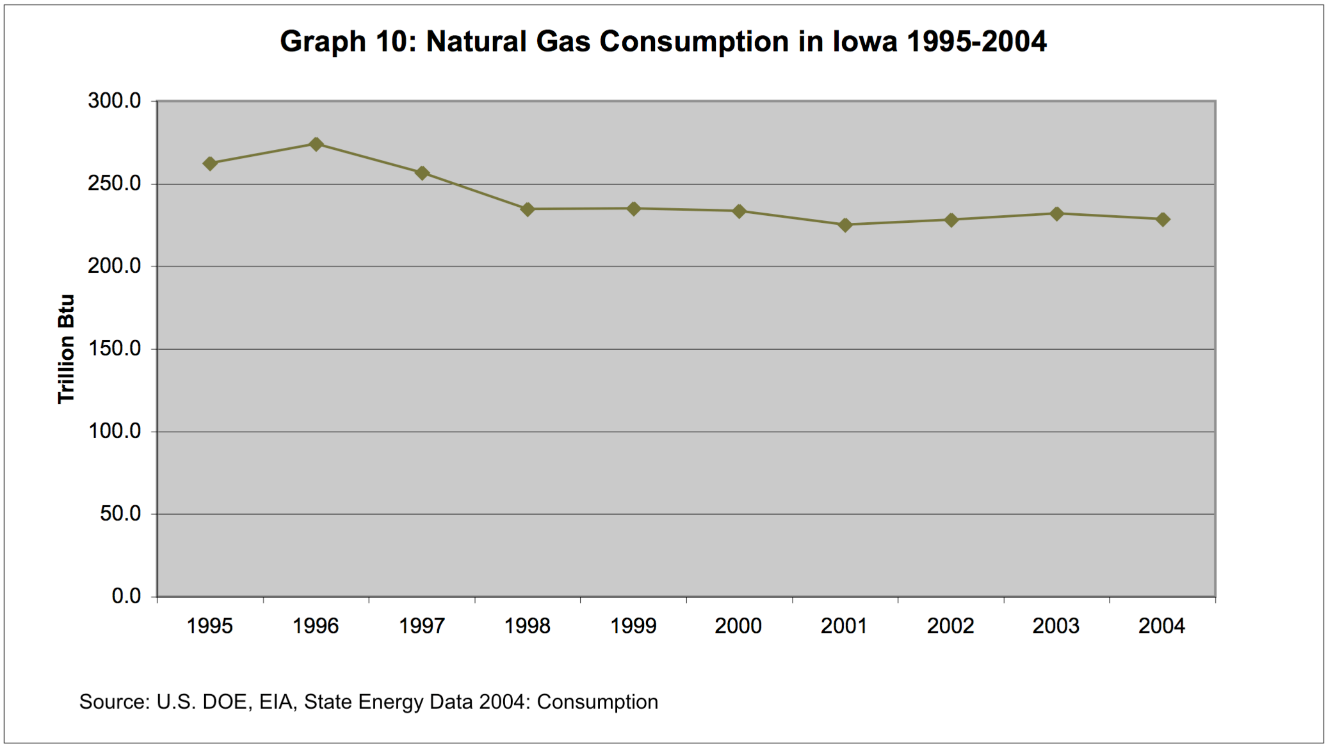
Coal

Coal consumption increased by 19.0% between 1995 and 2004. Growth was fastest between 1995 and 2000. Growth in coal use leveled off between 2000 and 2004.



Natural Gas

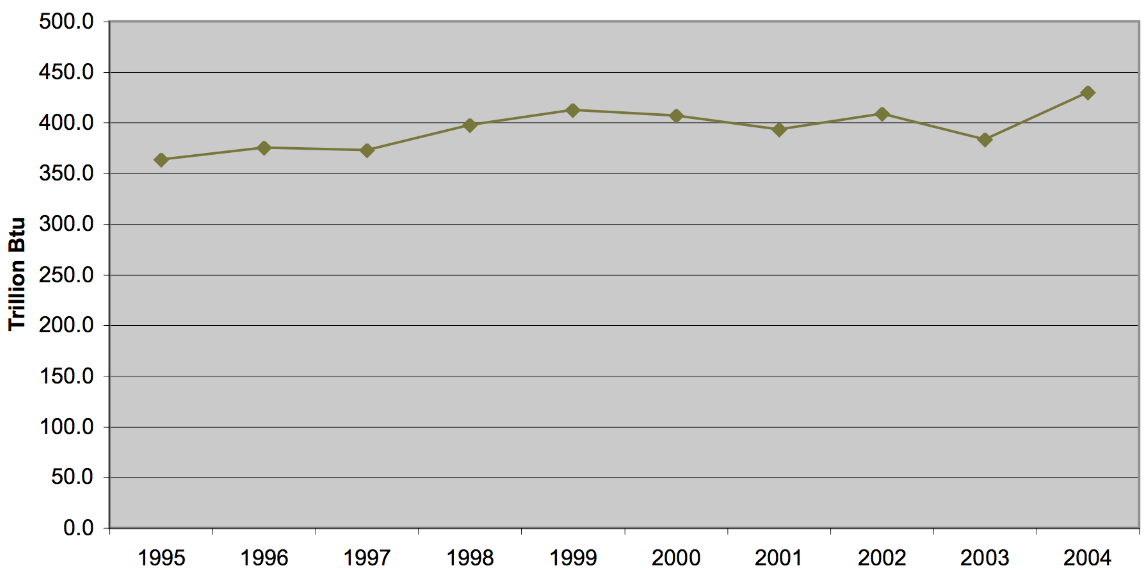
Natural gas use declined 12.9% between 1995 and 2004. Its use peaked in 1996 and declined steadily until 2001. Between 2001 and 2004 natural gas use was relatively stable.



Petroleum

Petroleum consumption grew 18.1% between 1995 and 2004 in Iowa. Growth was particularly rapid in 2004 when consumption rose 12.0% compared to 2003 despite gasoline prices being higher in 2004 than in 2003. Strong economic growth in 2004 was likely a significant factor behind the jump in petroleum consumption.

Graph 11: Petroleum Consumption in Iowa 1995-2004

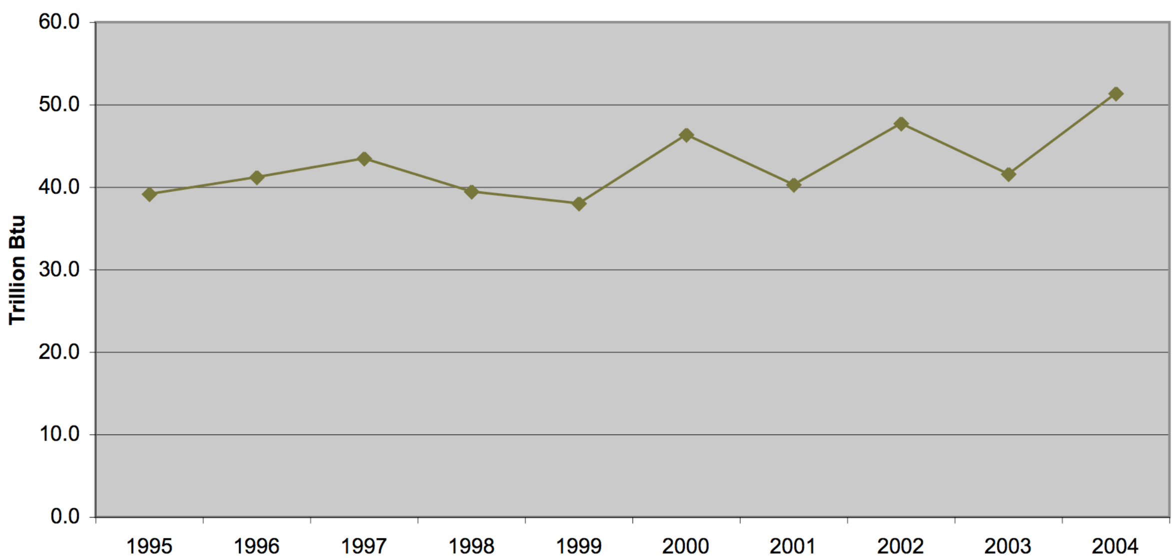


Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Nuclear Energy

Between 1995 and 2004, consumption of nuclear energy grew by 31.1%. Growth has been somewhat uneven, but the overall trend has been steady growth in the use of nuclear energy.

Graph 12: Nuclear Energy Consumption in Iowa 1995-2004

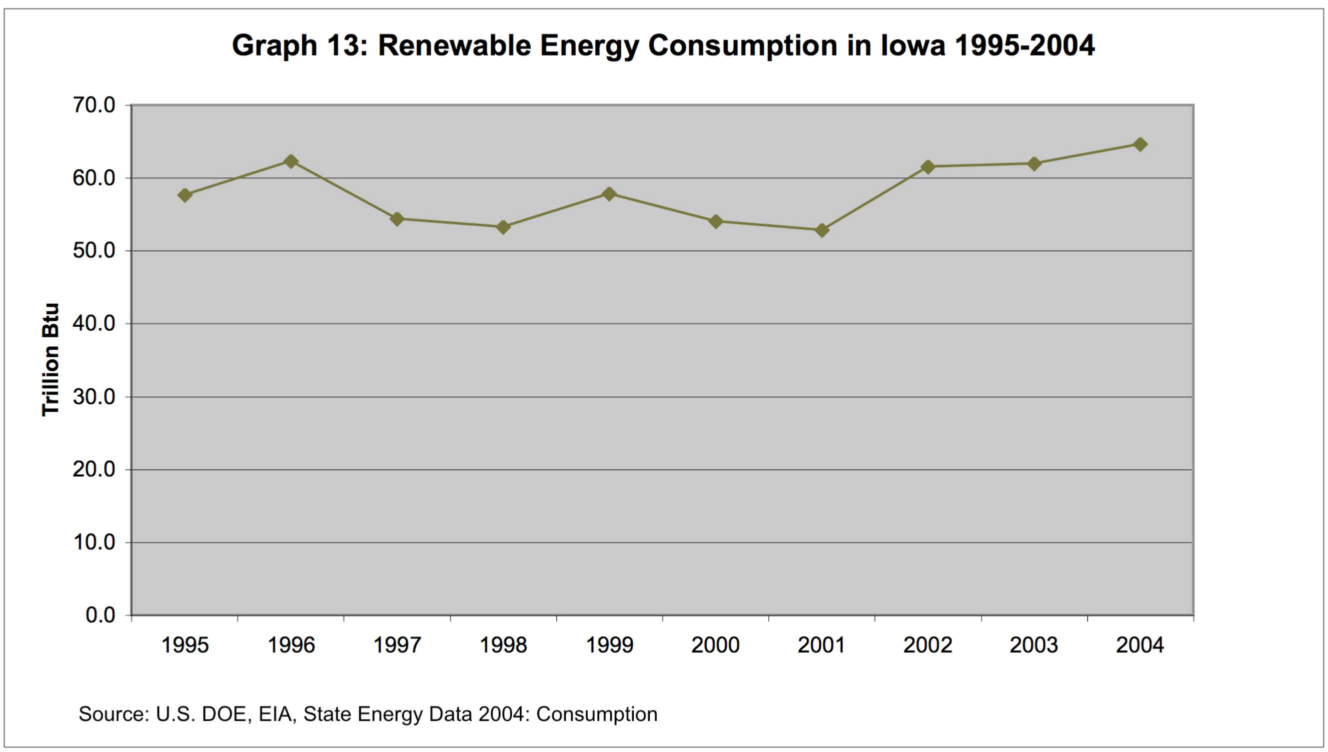


Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

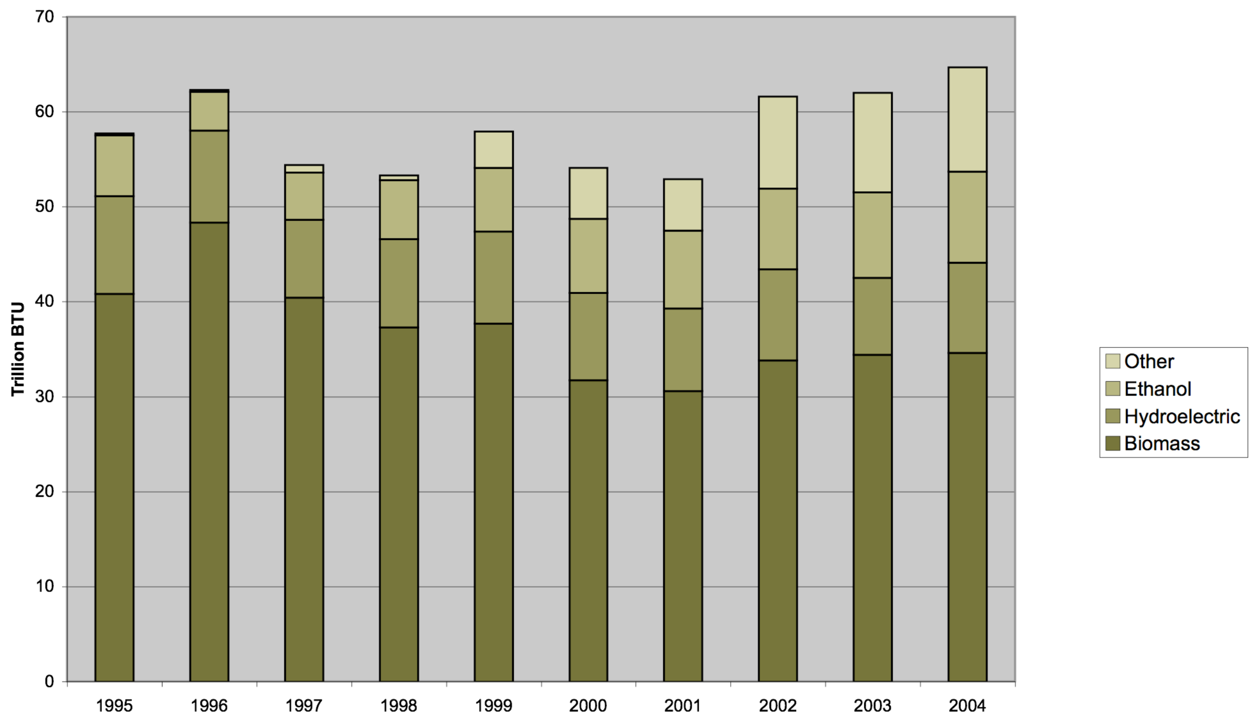
Renewable Energy

Graphs 13 and 14 show changes in renewable energy consumption and composition between 1995 and 2004. Overall, use of renewable energy increased 12.1% during the time period. Among the different types of renewable energy, use of hydroelectric power has remained steady between 1995 and 2004. Use of biomass declined between 1996 and 2001, but has slightly increased since 2002. Ethanol use has steadily increased from 1995 to 2004. The category "other" renewable energy, which includes wind, solar and geothermal energy, has grown rapidly since 1999. This is due to the fast growth of wind energy capacity in Iowa.

When analyzing Iowa data, it is important to note the difference between renewable energy consumption and production. With both ethanol and biodiesel, a relatively small portion of the fuel produced in Iowa is actually consumed in Iowa. Most of the production is exported. In addition, some Iowa wind farms produce electricity for out-of-state utilities and consumers.



Graph 14: Composition of Iowa Renewable Energy Consumption 1995-2004



Source: U.S. DOE, EIA, State Energy Data 2004: Consumption.
"Other" category includes wind, photovoltaic, geothermal and solar thermal energy.

C. Projection of Iowa's energy needs at a minimum through the year 2025

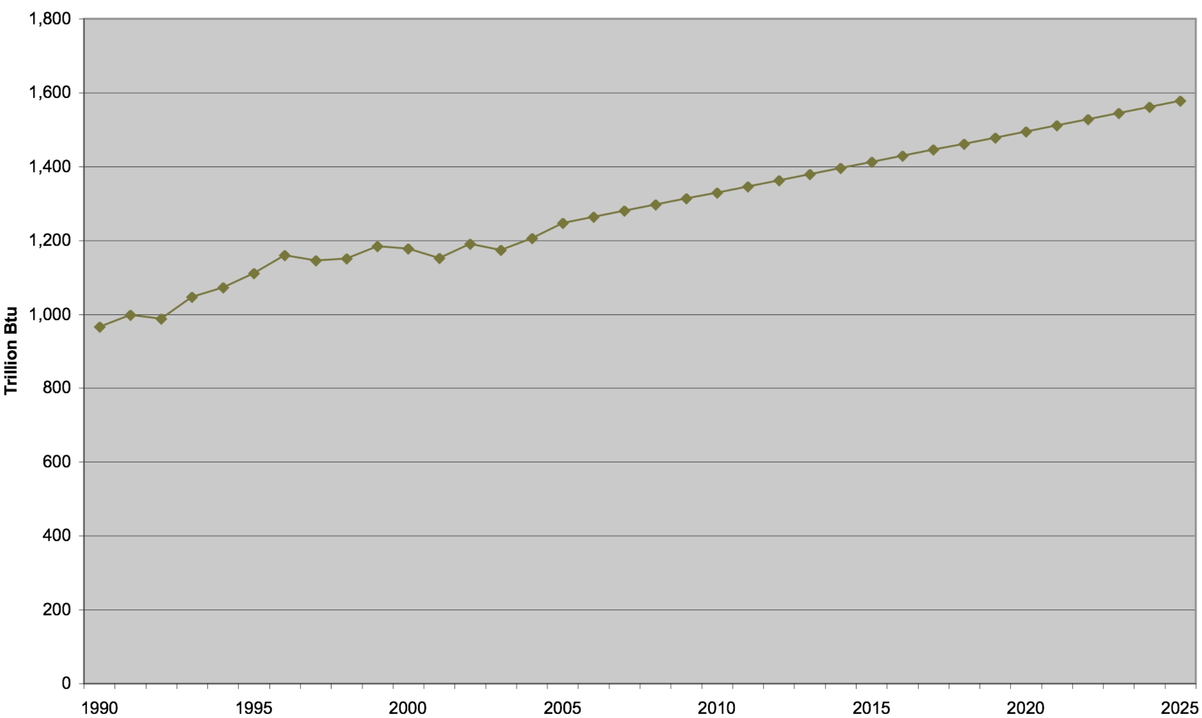
One must be aware of the precision and usefulness of long-term energy projections. We are unaware of any predictions from recent years that accurately portray the current mix of demographic, technological, economic, and political factors that have shaped Iowa's contemporary energy needs and consumption. Recognizing the inherent unreliability of forecasts so dependent on many unknown and inter-related variables, this section contains illustrations of Iowa energy consumption projected from 2004 data up to the year 2025.

The following graphs were generated with linear regressions utilizing 1990 to 2004 data. Such models cannot constitute exact calculation of future energy needs because they cannot account for any of the possible unknown factors, including increases in energy efficiency, changing technologies, public energy policies, market trends and forces, etc. In most cases, though, the models are a good fit for the data at hand, and do provide the kind of indications of future energy needs that are at least mathematically reasonable.

Total Energy Use

Iowa's total energy consumption in 2004 was 1,206 trillion BTUs. According to linear regression illustrated in Graph 15, Iowa's total energy consumption has been increasing at a rate of 16.5 trillion BTUs per year, and can be expected increase to about 1,578 Trillion BTUs per year by 2025. This would be an increase of 31 percent over 2004. The projected growth averages approximately 1.3% per year. By comparison, U.S. DOE Energy Information Administration projects the U.S. energy use to grow at a slightly slower annual pace at 1.1%.

Graph 15: Iowa Total Energy Use Projection

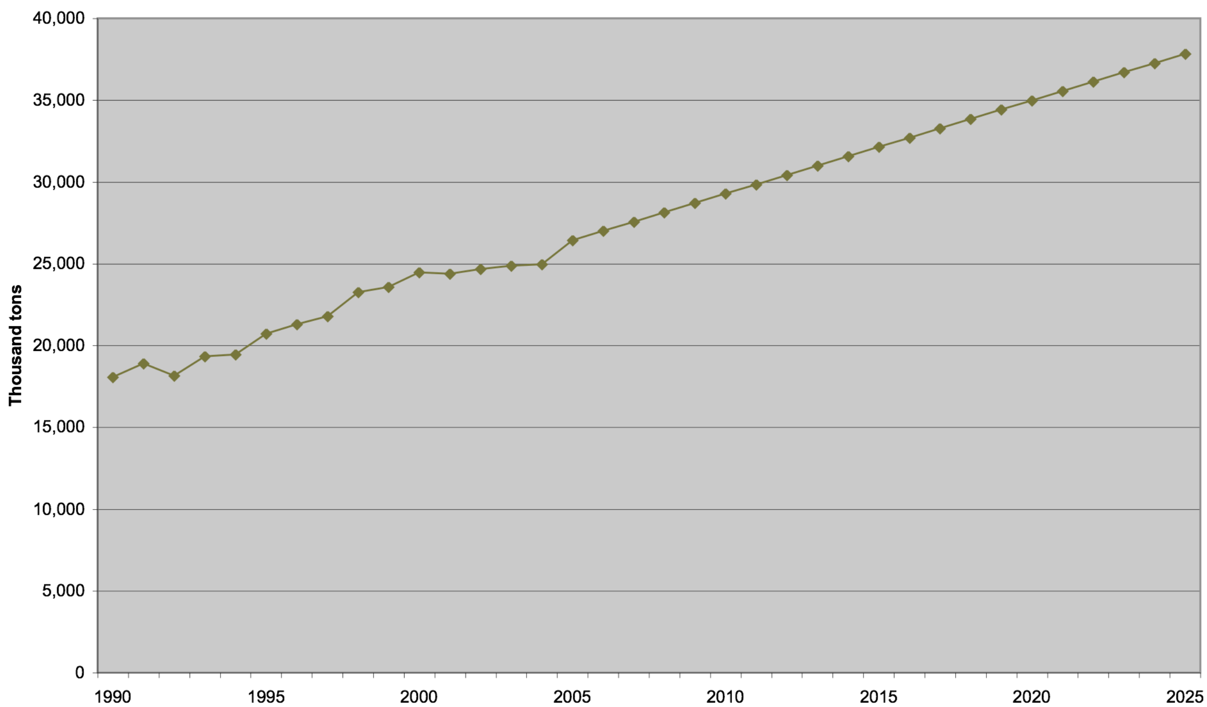


1990-2004 actual values. 2004-2025 projected values.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Coal

The latest coal consumption data from 2004 indicates that 25.0 million tons of coal was consumed in Iowa. The linear regression model predicts an increase of 570,000 tons per year for the future, which is roughly 1.5 to 2 percent annually. This is a growth equivalent to about 5,700 additional rail coal cars every year. Growth in consumption at this rate would increase consumption in 2025 to over 37.8 million tons, or 51% over 2004 consumption. The coal consumption growth rate will greatly depend on the choices that are made regarding Iowa's future electric generation resources. In June 2007, MidAmerican Energy placed in service a 790 MW new coal plant in Council Bluffs. As of fall 2007, at least two additional large coal-burning power plants are being proposed in Iowa. Adding these plants, and any other coal facilities, will have a significant impact on the growth rate of coal use in the state.

Graph 16: Iowa Coal Consumption Projection

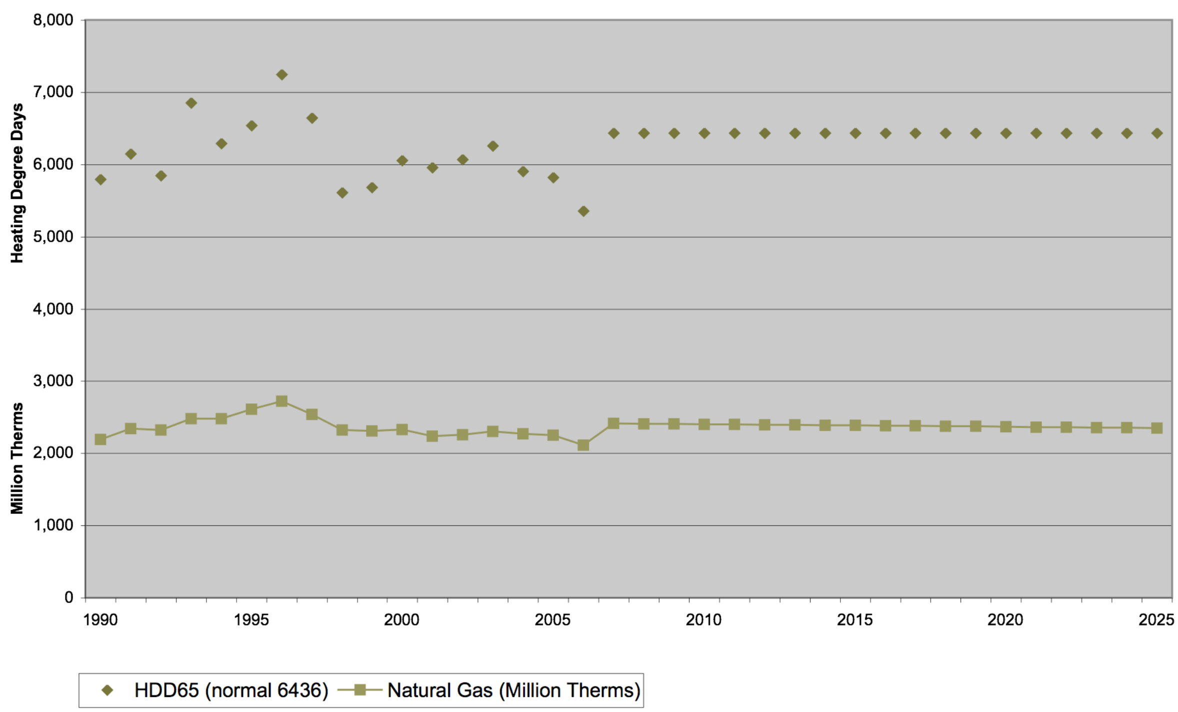


1990-2004 actual values. 2004-2025 projected values.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Natural Gas

Natural gas consumption in 2004 was approximately 2.27 billion Therms, which is equivalent to 227 billion cubic feet. The graph illustrates a strong correlation between heating degree-days and the amount of natural gas consumed. The linear regression model indicates slightly decreasing consumption of natural gas each year (between 0.14 and 0.15 percent). The graph below uses normal degree-days values for future years. Any significant changes in natural gas use, such as greater demand by ethanol industry, may greatly impact future consumption levels. Any changes to natural gas consumption that may already have happened due to the rapid growth of ethanol industry between 2005 and 2007 is not shown in the graph because natural gas consumption data beyond 2004 is not yet available from the U.S. Department of Energy.

Graph 17: Iowa Natural Gas Consumption Projection

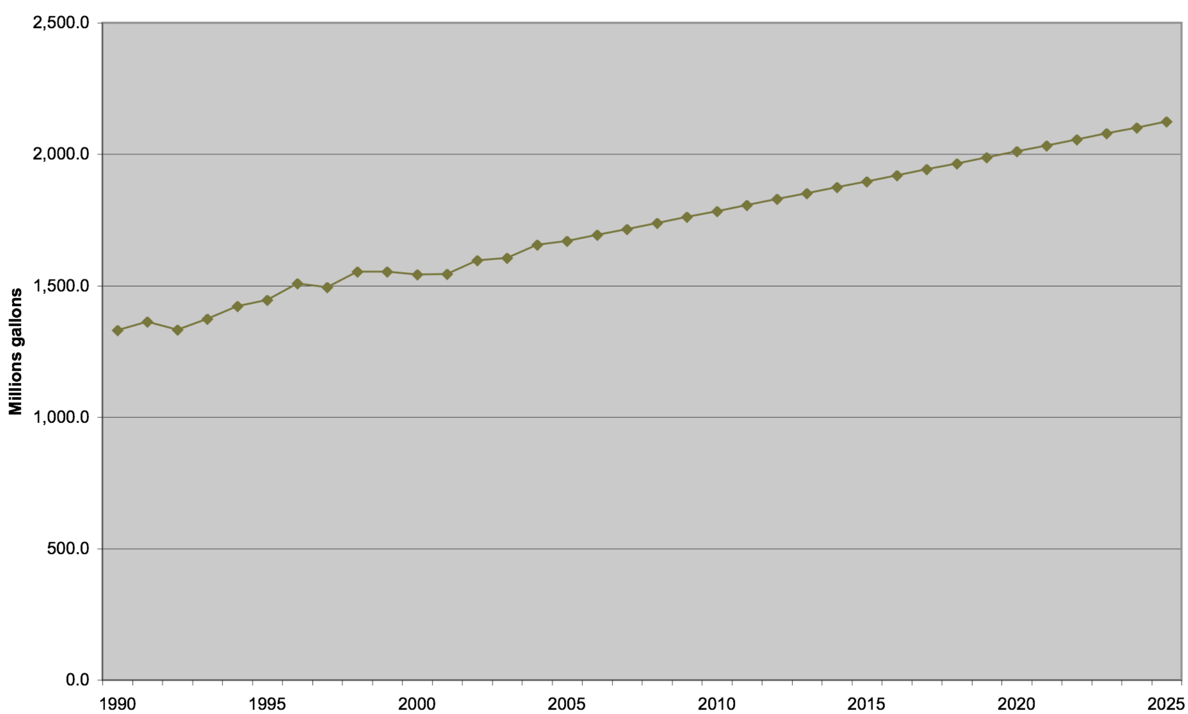


Note: For heating degree days, actual values for 1990-2006; normal value of 6436 for 2007-2025. For natural gas, actual values for 1990-2004; projected values for 2004-2025.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Motor Gasoline

Iowa's motor gasoline consumption in 2004 was 1.66 billion gallons. This is equal to about 221,000 delivery tanker trucks per year (7,500 gallons each). The projected yearly increase based on the linear regression model is the equivalent of an additional 22.7 million gallons annually (3,027 more tanker delivery truckloads every year), amounting to one to 1.4 percent growth annually.

Graph 18: Iowa Motor Gasoline Consumption Projection

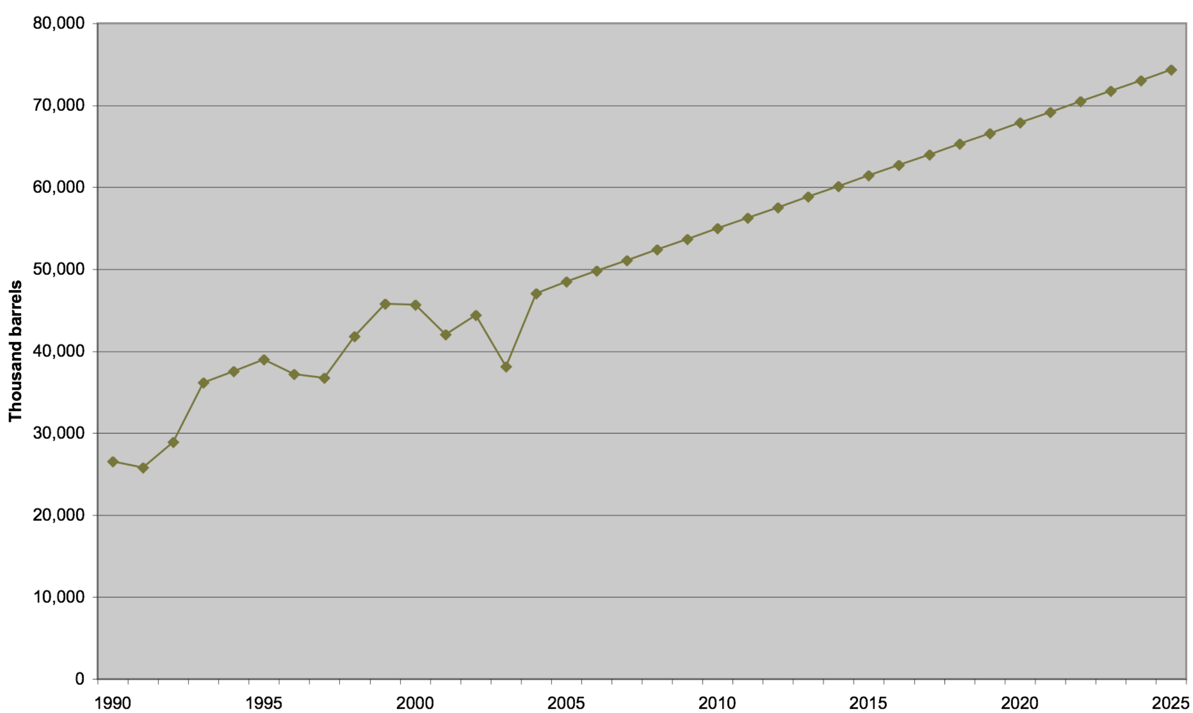


1990-2004 actual values. 2004-2025 projected values.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Petroleum (excluding motor gasoline)

Consumption of petroleum (not counting motor gasoline) includes asphalt and road oil, aviation gasoline, distillate fuel, jet fuel, kerosene, liquefied petroleum gases, lubricants, residual fuel, and 'other' (a variety of 16 special-use products consumed in the industrial sector). In 2004, Iowa consumption was about 47.1 million barrels; a recovery to previous levels after a considerable drop in 2003 that was likely due to high crude oil prices at the time. The positive slope of the graph indicates an increase in petroleum use overall of about 1.3 million barrels per year, which is between 1.7 and 3.0 percent annually.

Graph 19: Iowa Petroleum Consumption Projection

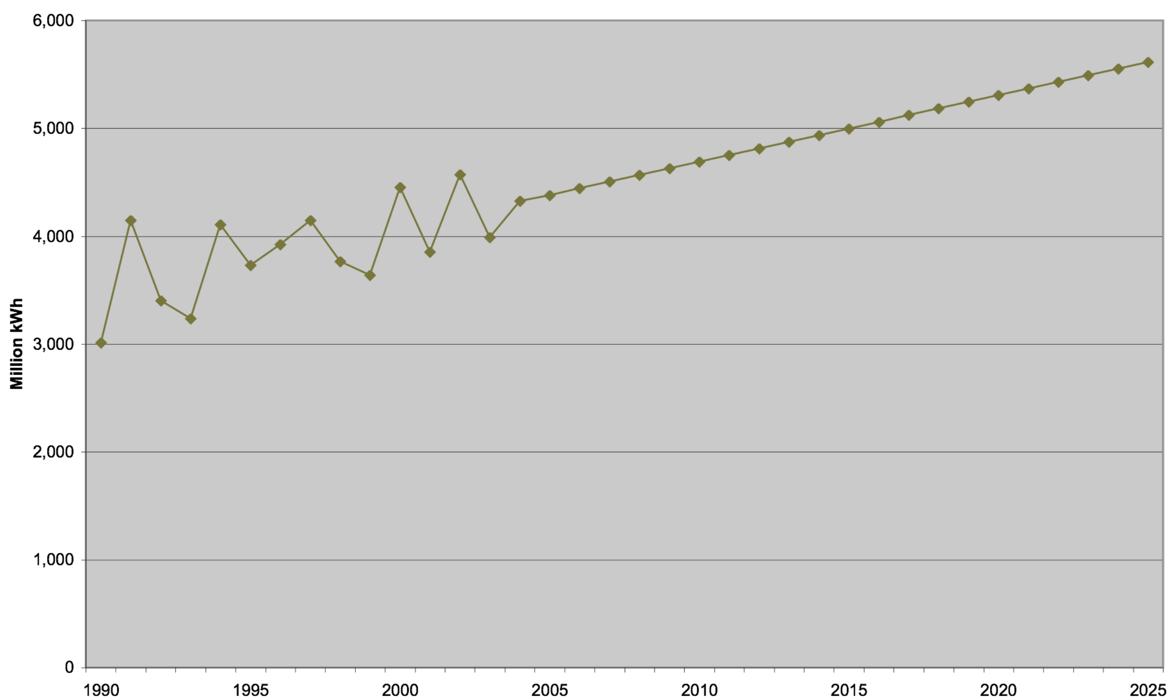


1990-2004 actual values. 2004-2025 projected values.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Nuclear Energy

The use of nuclear energy in Iowa produced 4.3 billion kilowatt-hours of electricity in 2004. The results of the linear regression model predict an annual increase of more than 61.7 million kilowatt-hours (kWh), which is a growth rate of 1.1 to one and 1.4 percent per year. Electricity from nuclear energy is projected by the model to exceed 5.6 billion kWh by 2025. Because nuclear power plants are very large facilities, adding a new nuclear plant to the generation mix in Iowa would change the growth projection significantly.

Graph 20: Iowa Nuclear Energy Consumption Projection

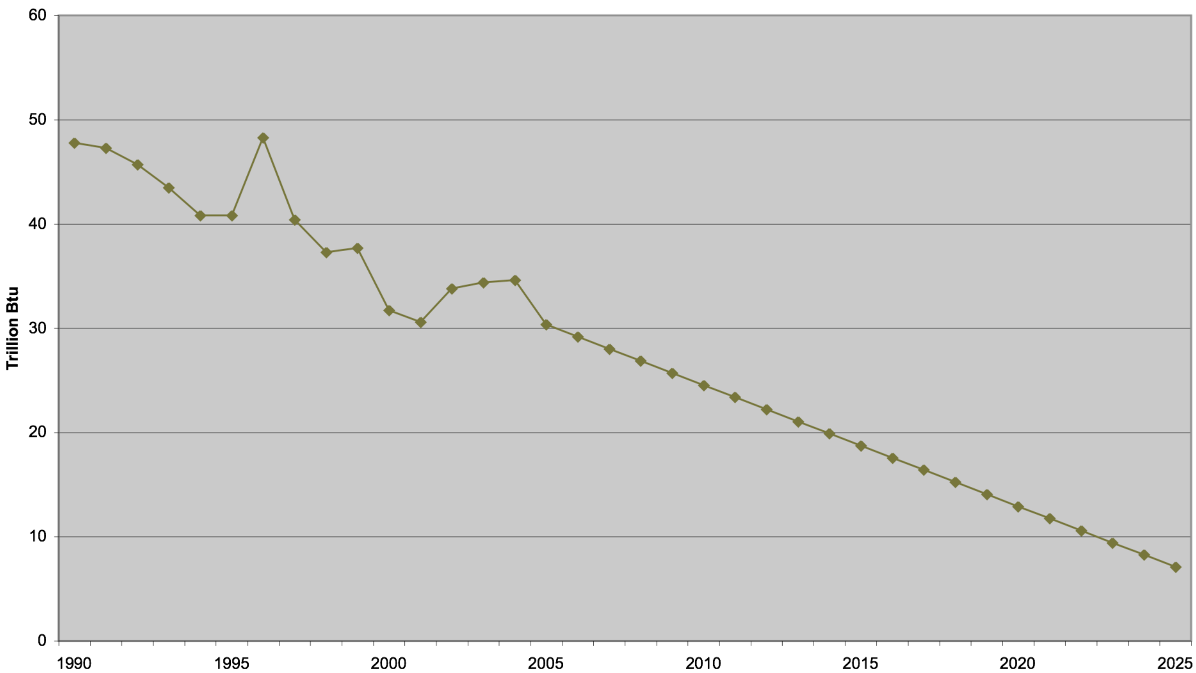


1990-2004 actual values. 2004-2025 projected values.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Biomass

Biomass is comprised primarily of wood and various organic waste materials. Biomass is a minor component of Iowa's energy supply, and the linear regression model indicates that it has been decreasing between 1990 and 2004. In particular, use of biomass decreased fairly significantly in the industrial sector between 1990 and 2001. Use of wood in the residential sector also declined between 1990 and 2001. However, between 2001 and 2004, the biomass consumption graph rebounded. This may indicate a reversal of the long-term declining trend predicted by the linear regression model.

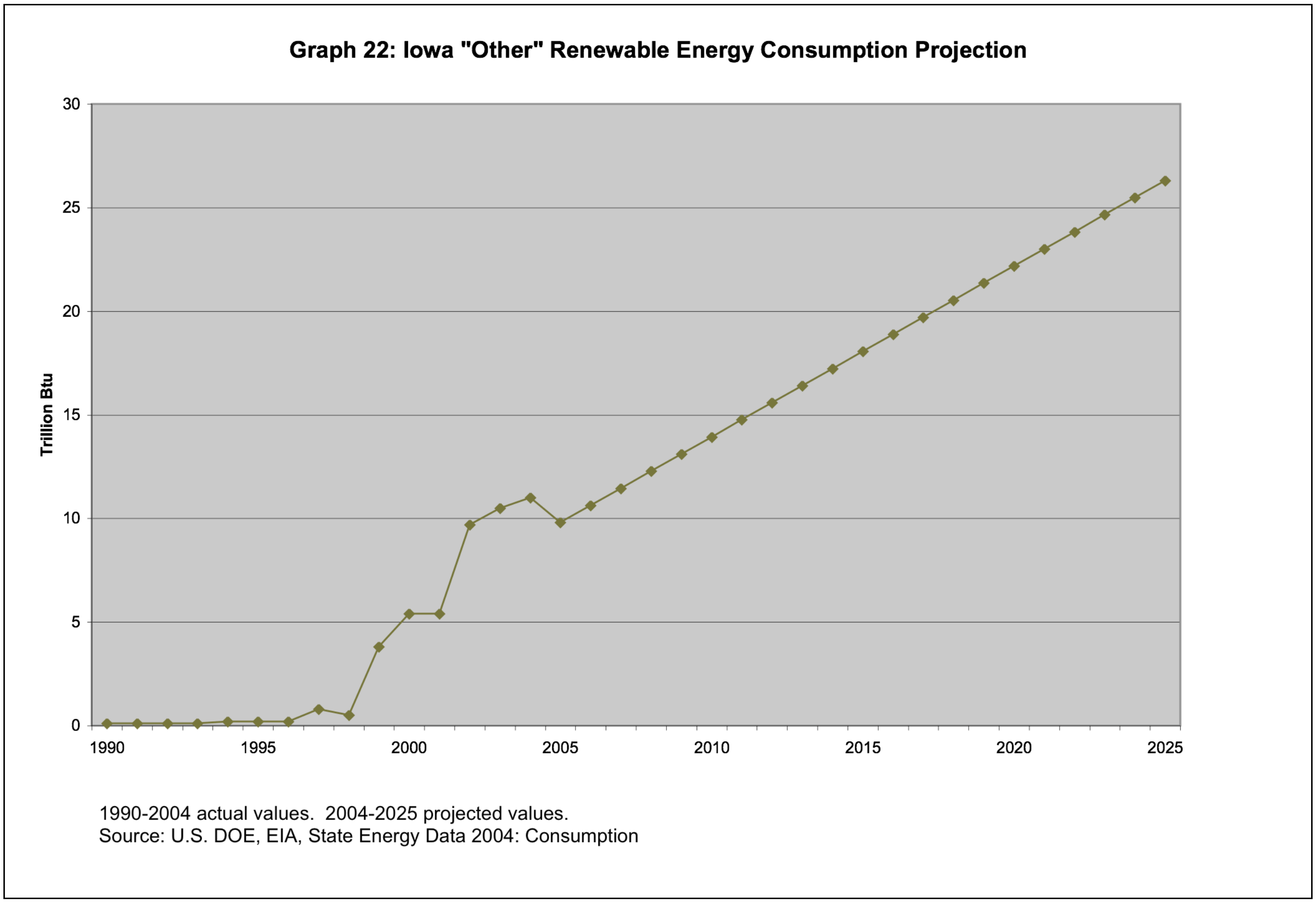
Graph 21: Iowa Biomass Consumption Projection



1990-2004 actual values. 2004-2025 projected values.
Source: U.S. DOE, EIA, State Energy Data 2004: Consumption

Other Renewable Energy Sources

A catch-all "Other" renewable energy category is comprised of hydroelectric, wind, photovoltaic and solar-thermal energy sources. Nearly all of the increase in this category since 1999 has been due to the surge in wind energy generation. The low baseline years here may unduly cause the underlying linear regression model to show a lower projection graph than the last few years of growth would otherwise indicate. As in the past, the growth rate of wind energy will likely continue to be strongly affected by public policies, such as tax incentives and government-set renewable energy production requirements.



D. Impact of meeting Iowa's energy needs on the economy of the state, including the impact of energy efficiency and renewable energy on employment and economic development

Energy Expenditures

Iowa's energy bill in 2004 was $10.1 billion, the highest expenditure ever recorded until that time. This is an 18.2% increase from 2003. Table 9 shows a five-year summary of the major categories of energy expenditures in Iowa. The total expenditure in 1999 ($6.623 billion) was nearly the highest recorded until that time. Thus, energy expenditures from 2000 to 2004 were the highest ever recorded until that time. Data over the 2000 to 2004 period shows the volatility of expenditures for natural gas and petroleum due to price fluctuations over the period.

Table 9: Energy Expenditures for Principal Energy Sources, 2000-2004

Year	In Millions of Dollars *									
	Coal		Natural Gas		Petroleum		Other Sources **		Total	
2000	$405.2	1 year change	$1,453.3	1 year change	$4,433.9	1 year change	$1,990.2	1 year change	$8,282.6	1 year change
2001	$401.8	-0.8%	$1,592.2	9.6%	$4,084.7	-7.9%	$2,089.3	5.0%	$8,168.0	-1.4%
2002	$426.2	6.1%	$1,297.4	-18.5%	$3,936.2	-3.6%	$2,122.2	1.6%	$7,782.1	-4.7%
2003	$424.5	-0.4%	$1,682.8	29.7%	$4,269.4	8.5%	$2,176.1	2.5%	$8,552.8	9.9%
2004	$442.4	4.2%	$1,833.1	8.9%	$5,608.8	31.4%	$2,226.7	2.3%	$10,111.0	18.2%

* Nominal dollars; not adjusted for inflation.

** Other sources include nuclear fuel, biomass, net in-flow of electric energy, and retail electricity.

Table 10: Proportions of Energy Expenditures - 2004

Energy Source	**Expenditures**	**Percentage**
Coal	$442,400,000	4.4%
Natural Gas	$1,833,100,000	18.1%
Motor Gasoline	$2,897,500,000	28.7%
All Other Petroleum	$2,711,300,000	26.8%
Nuclear	$28,500,000	0.3%
Biomass	$21,900,000	0.2%
Net Flow of Electricity *	($442,200,000)	-4.4%
Retail Electricity	$2,618,500,000	25.9%
Total	$10,111,000,000	100.0%

* A negative value indicates that more electricity went out of the State than came into the State.

Most of the growth in Iowa's energy expenditures shown in Table 9 came from sharp increases in petroleum and natural gas prices. Table 11 shows that, from 2000 to 2004, coal prices increased 10 percent ($0.91 to $1.00/MMBtu), natural gas prices increased 30 percent ($6.45 to $8.40/MMBtu) while gasoline prices increased 21 percent ($11.67 to $14.09/MMBtu). Overall, total petroleum prices (including gasoline) increased 19 percent ($9.90 to $11.80/MMBtu).

Table 11: Energy Price Changes, 2000-2004

	Dollars per Million BTUs (MMBtu) *				
Year	**Coal**	**Natural Gas**	**Gasoline**	**All Petroleum**	**Total (All Energy)**
2000	$0.91	$6.45	$11.67	$10.74	$9.90
2001	$0.91	$7.36	$11.12	$10.22	$10.05
2002	$0.97	$5.97	$10.54	$9.47	$9.27
2003	$0.95	$7.57	$11.93	$10.91	$10.39
2004	$1.00	$8.40	$14.09	$12.81	$11.80
Average	*$0.95*	*$7.15*	*$11.87*	*$10.83*	*$10.28*

* Nominal dollars; not adjusted for inflation.

<u>Expenditure "Leakages"</u>

More than 95% of Iowa's primary energy sources come from out of state. However, not all of Iowa's energy expenditures on the imported energy sources leak out of state. Iowa State University (ISU) Department of Economics report from December 2005 "Analysis of Energy Supply and Usage in the Iowa Economy" observes that there is considerable economic activity involved in getting primary energy processed, converted and distributed to final consumers and businesses. Much of this added value is generated within the Iowa economy. The ISU study analyzed energy expenditures and the share of those expenditures that leave the state for three forms of energy: natural gas, petroleum, and electricity. As seen in Table 12, this leakage of expenditures is greatest for natural gas at 52.4%. With electricity, only 17.8 % of total expenditures leak out of state. This lower percentage is due to the fact that most electric generation occurs in Iowa and the distribution functions are all within the state.

Table 12: Energy Leakages in Iowa

Energy	2001 Expenditure ($ billion)	Leakage (percent)	$ Exported ($ million)
Natural Gas	1.59	52.4 %	834.5
Petroleum	4.08	41.6 %	1,697.3
Electricity	2.41	17.8 %	428.6
Total	8.08	36.6 %	2,960.4

Status of Fast Growing Renewable Energy Industries

Biofuels

Iowa is the leading producer of both ethanol and biodiesel. According to the Iowa Renewable Fuels Association, as of December 2007 there were 29 ethanol refineries in Iowa with a total annual production capacity of 2 billion gallons. Additional capacity of 1.36 billion gallons was under construction at that time. As of December 2007, Iowa's 14 biodiesel refineries had the capacity to produce 317 million gallons annually, with an additional 34 million gallons of capacity under construction.

Wind Energy

Over the last two years Iowa has also been able to attract several wind industry manufacturing facilities. Clipper Windpower started wind turbine production at its Cedar Rapids plant in 2006. The initial investment in the facility was $22 million, and the plant employs more than 140 people. Siemens Power Generation invested approximately $17 million in its Mt. Pleasant wind turbine manufacturing facility. Blade production at the plant started in early 2007, and the facility is expected to employ 250 people. Acciona Windpower's is building a turbine manufacturing facility in West Branch. The $23 million plant is expected to be operating by the end of 2007 and create more than 100 jobs. In addition, Denmark-based Hendricks Industries has announced that it plans to open a wind turbine tower manufacturing facility in Keokuk, and TPI, a Rhode Island company, has announced the development of a wind turbine blade manufacturing facility in Newton.

Economic Impacts of Renewable Energy and Energy Efficiency

The actual economic impact of renewable energy development and energy efficiency can be difficult to determine, but various studies have attempted to analyze those effects. Comparison of results is difficult due to differing focus areas and methodologies of the studies.

A 2006 study by the University of Tennessee attempted to estimate, on the national level, the economic impact of producing 25% of the nation's total energy demand from agriculture and forestry resources by year 2025. The study concluded that the "25 X '25" goal is achievable and can be met without compromising the agricultural sector's ability to reliably produce food, feed and fiber at reasonable prices. According to the study, reaching the goal would have a very favorable impact on rural America and the nation as a whole. Including multiplier effects in the economy, the estimated annual impact on the nation would be more than $700 billion in economic activity and 5.1 million jobs in 2025. Studies in other states also point to positive economic impacts from energy efficiency and renewable energy technologies. A September 2007 study by the American Council for an Energy Efficient Economy concluded that in Texas cost-effective investments in a combination of energy efficiency and renewable energy technologies can reduce overall electricity costs, boost net employment, and reduce air pollutants. According to an accompanying ACEEE study, even in the fastest growing metropolitan areas of Texas, rising electricity needs can be met with energy efficiency and renewable energy.

Biofuels & wind energy

Iowa State University study "Analysis of Energy Supply and Usage in the Iowa Economy" did not calculate the percentage of expenditure leakage out of state for biofuels industry. The analysis model used in the study did indicate that 55 % of ethanol input stream comes from in-state resources. Thus, increased use of ethanol lessens Iowa's energy expenditure leakage. Among the major out-of-state components in ethanol production are the primary fuels – natural gas and coal – that are used to power ethanol plants.

The ISU study analyzed the economic impact on the Iowa economy of exporting 800 million gallons of ethanol annually (Iowa's ethanol export level at the time of the study). According to the study, 800 million gallons of annual ethanol production created 2,402 jobs and generated $2.2 billion in sales and $80 million in household income.

Other studies have indicated greater impact from biofuels industry on Iowa's economy. In a study commissioned by Iowa Renewable Fuels Association and published in February 2007, John Urbanchuk of LECG LLC estimated the economic contributions of both ethanol and biodiesel industries in Iowa. The study was based on production capacity levels at the end of 2006. The study estimated that the 1.7 billion gallon ethanol production capacity contributed $7.3 billion to Iowa Gross Domestic Product, supported the creation of 47,000 jobs, generated $1.7 billion in household income, and generated $350 million in state tax revenue. It was estimated that the 115 million gallon biodiesel production capacity contributed $900 million to Iowa GDP, supported the creation of 6,100 jobs, generated $104 million in household income, and generated $36.5 million in state tax revenue.

Authors of the Iowa State University study "Analysis of Energy Supply and Usage in the Iowa Economy" acknowledge that their modeling was unable to account for all market effects of ethanol production and its continued growth. Ethanol industry growth affects many production relationships in broad areas of the economy, such as livestock industry, soybean production and processing, rail and road transportation, and grain warehousing. The sheer quantity of corn needed to supply Iowa's growing ethanol industry is significant. When all of Iowa's 3.5 billion gallon per year ethanol capacity that is currently under construction comes online, the industry is expected to utilize approximately 1.23 billion bushels of corn. (On average, one bushel of corn yields 2.8 gallons of ethanol.) This 1.23 billion bushel demand is approximately 50% of Iowa's estimated total corn crop of 2.44 billion bushels in 2007. Recent anecdotal evidence appears to confirm that some of the effects of ethanol production on other industries can be significant. For example, decreased soybean acreage due to increased corn production to supply the ethanol industry has been linked to increased prices for soybeans. Higher soybean prices are having an effect on all industries that use soybeans as feedstock, including the biodiesel industry.

The modeling used in the Iowa State University study was unable to analyze the economic impacts of wind energy development. However, the authors of the study concluded that, based on the assessment of other energy generating activities, it is likely that wind energy provides greater in-state economic impacts than electric generation that utilizes imported fuel. While most of the wind turbines are manufactured outside the state, the construction and subsequent operation and maintenance are mostly in-state expenditures.

Effects of energy policies

Two recent studies, by Union of Concerned Scientists and Environment Iowa Research & Policy Center, attempted to estimate economic impacts of more aggressive renewable energy and energy efficiency development in Iowa.

The Environment Iowa Research & Policy Center study "Redirecting Iowa's Energy," published in 2006, estimated the economic and consumer impact of two different energy development strategies. Scenario 1 considered the impact of enacting a 20 % renewable portfolio standard (RPS) by 2020 and funding a publicly-run energy efficiency program at an annual funding level of $50 million from 2007 to 2020. Scenario 2 considered the impact of a 20 % renewable RPS by 2020 and funding a publicly-run energy efficiency program at an annual funding level of $100 million from 2007 to 2020. Of the new jobs created by the two scenarios, more than half occurred in the service sector. The modeling showed strong employment growth also in construction, retail, finance and manufacturing sectors. The economic and consumer impacts of both scenarios are included in Table 13.

Table 13: Economic Impact Summary of Environment Iowa Study

Impact	Scenario 1: 20% RPS, $50M EE	Scenario 2: 20% RPS, $100M EE
Net job increase in 2020 (actual)	2,340	5,166
Net increase in wages in 2020 (2001 dollars)	$31 million	$37 million
Annual electric savings in 2020 (2001 dollars)	$147 million	$440 million

In a 2007 study, Union of Concerned Scientists evaluated the economic impacts of a national 20 % renewable portfolio standard in Iowa. A summary of the impact is seen in Table 14. The projected consumer savings in electricity and natural gas expenditures are attributed to reduced demand for fossil fuels and the creation of new competitors in the energy market. According to the study, renewable energy technologies tend to create more jobs than fossil fuel technologies because a larger share of the expenditures is spent on manufacturing equipment, installation and maintenance. All of these activities are typically more labor intensive than extracting and transporting fossil fuels. Another local economic benefit of renewable energy is the fact that fuel expenditures are not exported out of state, keeping money circulating in the local economy.

Table 14: Economic Impact Summary of UCS Study

Impact	Effect of 20% RPS by 2020
New jobs	2,130
New capital investment	$769 million
Farmer & rural landowner income	$527 million
New local tax revenue	$27 million
Consumer savings in electricity, natural gas (cumulative)	$83 million

Number and composition of renewable energy and energy efficiency jobs

A 2007 study by the American Solar Energy Society and Management Information Services, Inc. evaluated the size and composition of renewable energy and energy efficiency industries in the United States in 2006. Table 15 summarizes findings of the study. Comparable data for Iowa is not available at this time. The U.S. study indicates that the energy efficiency industry is currently much larger than the renewable energy industry, but the latter is growing more rapidly. Of the more than 8 million jobs in the energy efficiency sector, 98% are in private industry. More than 50% of energy efficiency industry jobs are in the manufacturing sector. Recycling and construction sectors are other significant employers in the energy efficiency industry. In the renewable energy sector, 95% of the jobs are in the private sector. Nearly 70% of the renewable energy jobs are in the biomass sector – primarily in ethanol and biomass power. Wind energy employs the second most people in the renewable energy industry.

Table 15: U.S. Renewable energy and energy efficiency industry employment

Industry	Revenues (billions)	Direct jobs	Direct & indirect jobs created
Renewable energy	$39.2	194,000	446,000
Energy Efficiency	$932.6	3,498,000	8,046,000

The American Solar Energy Society study also evaluated the composition of a typical 250-employee wind turbine manufacturing company. The study concluded that such a renewable energy facility typically employs a wide range of workers at all educational and skills levels at widely differing earnings levels. The average annual salary at a typical wind turbine manufacturer was estimated at $46,400. The analysis also revealed that the job distribution at a typical renewable energy manufacturing facility appears to differ relatively little from that of a company that manufactures other products. Most of these employees are considered "renewable energy workers" only because the company they work for is manufacturing a renewable energy product.

E. Impact of meeting Iowa's energy needs on the environment of the state, including the impact of energy production and use on greenhouse gas emissions.

Greenhouse gas emissions

Senate File 485 passed by the Iowa Legislature in 2007 and signed into law by Governor Culver creates a greenhouse gas inventory and a greenhouse gas registry for the state. Iowa DNR will collect, through mandatory reporting, data from the emitters of greenhouse gases to compile the GHG inventory. The GHG registry will be a voluntary mechanism for the purpose of cooperating with other states in tracking, managing and trading emissions credits. The creation of the GHG inventory will produce a more detailed accounting of Iowa's GHG emissions. SF 485 also created Iowa Climate Change Advisory Council. The 23-member Council will produce a report to the Governor and Legislature on multiple scenarios designed to reduce statewide GHG emissions. The report is due by January 1, 2008.

According to "Year 2000 Iowa Greenhouse Gas Emissions Inventory" study produced by the Center for Energy and Environmental Education at the University of Northern Iowa, energy-related activities contributed 67% of all Iowa GHG emissions in 2000. Table 16 below details the breakdown of energy-related GHG emissions in Iowa. The vast majority of these energy-related emissions come from carbon dioxide (CO_2) emissions from combustion of fossil fuels. Fugitive emissions and storage leaks from natural gas transmission and distribution systems comprised the second largest category in energy-related emissions. Emissions of methane (CH_4) and nitrous oxide (N_2O) from mobile combustion and N_2O from stationary combustion sources are much less significant sources of emissions.

Table 16: Iowa Greenhouse Gas Emissions from Energy-Related Sources in 2000

Type of Emission	**MTCE (metric tons carbon equivalent)**
CO_2 from fossil fuel combustion	21,268,523
CH_4 from natural gas systems	553,278
CH_4 from mobile sources	14,212
N_2O from mobile sources	172,033
N_2O from stationary combustion	61

According to the University of Northern Iowa study, total carbon dioxide emissions from fossil fuel combustion increased 24.4 % between 1990 and 2000. Table 17 details CO_2 emission changes in the different economic sectors between 1990 and 2000. CO_2 emissions growth was fastest in the industrial sector at 27.5%, followed by the transportation sector at 15.5 % and commercial sector at 10.8 %. CO_2 emissions from residential sector remained nearly steady, increasing only 0.6 % between 1990 and 2000.

Table 17: Iowa CO_2 Emissions by Sector 1990, 2000

Sector	1990 Million MTCE	2000 Million MTCE	% Change 1990-2000
Residential	3.874	3.898	0.6%
Commercial	2.694	2.984	10.8%
Industrial	6.032	7.688	27.5%
Transportation	4.405	5.087	15.5%
Net interstate flow of electricity	-0.041	1.611	
Total	16.964	21.268	25.4%

Electric utility emissions are distributed among commercial, residential and industrial sectors in Table 17. CO_2 emissions by electric utilities in Iowa increased by 34.1 % between 1990 and 2000, as illustrated in Table 18. The percentage of electric utility CO_2 emissions of all CO_2 emissions grew from 41.8% in 1990 to 44.8% in 2000.

Table 18: Iowa CO_2 Emissions from Electric Utilities 1990, 2000

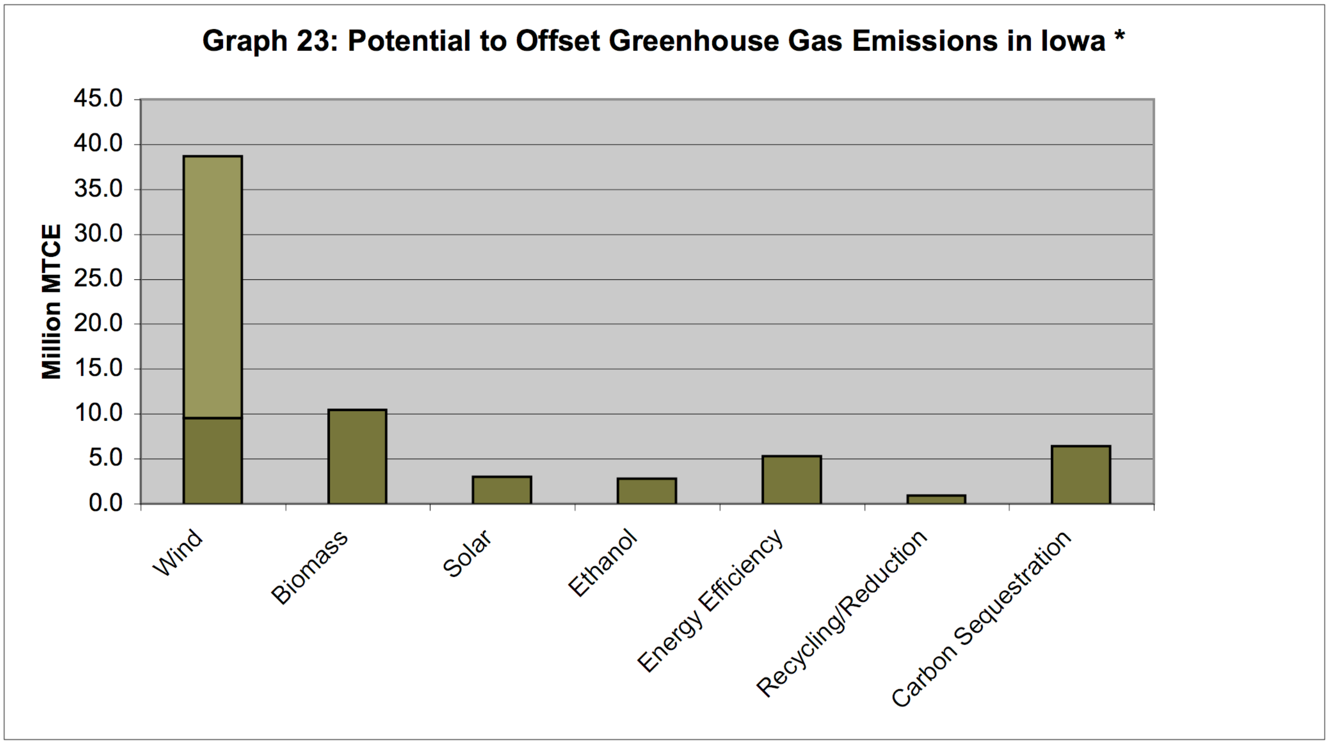
Sector	1990 Million MTCE	2000 Million MTCE	% Change 1990-2000
Electric Utilities	7.098	9.519	34.1%

Table 19 contains electric utility CO2 emissions estimates by fuel type, as reported by the U.S. Department of Energy. In 2006, 96.7 % of Iowa's electric power sector CO_2 emissions came from combustion of coal. Between 1990 and 2000, CO_2 emissions from coal increased by 39.5%. CO_2 emissions from coal declined by 2.7% between 2000 and 2006. Total CO_2 emissions from electric utilities declined 1.6 % between 2000 and 2006, but the 2006 CO_2 emission level was still 37.5 % above the 1990 level.

Table 19: Iowa Electric Utility CO_2 Emissions by Fuel Type 1990, 2000, 2006

Fuel	1990 CO_2 Emissions (thousand metric tons)	2000 CO_2 Emissions (thousand metric tons)	2006 CO_2 Emissions (thousand metric tons)
Coal	28,927	40,362	39,256
Petroleum	61	113	255
Natural Gas	510	766	1,055
Renewables	1	3	11
Total	29,500	41,244	40,577

The University of Northern Iowa study also analyzed the potential of various technology options to offset GHG emissions in Iowa. A summary of the offset potential is illustrated in Graph 23. Wind energy has the greatest offset potential in Iowa, followed by combustion of biomass, carbon sequestration (in living plant tissue and as organic matter in soil) and energy efficiency.



*Graph shows annual reduction potentials in million MTCE. Solid area under wind signifies emissions offset if wind generated electricity were to equal state's total electricity consumption in 2000; combined solid and hatched area corresponds to emission offsets if wind-generated electricity were to produce four times the state's year 2000 consumption.

Other Emissions

The energy sector is a significant contributor to other environmental pollutants besides CO_2. Table 20 details emission estimates for sulfur dioxide (SO_2) and nitrogen oxide (NO_X) from Iowa's electric power industry in 1990, 2000 and 2006 as reported by the U.S. DOE. The vast majority of emissions for both pollutants come from coal-fired electric generation. Even though electric generation from coal increased by 34% between 1990 and 2006, emissions of both SO_2 and NO_X have decreased significantly. Between 1990 and 2006, emissions of SO_2 decreased by 28% and NO_X by 60%. These reductions can be attributed to better emissions controls at Iowa's coal-fired generating facilities. SO_2 is a primary component of fine particulate matter, or "soot." Fine particulates have been tied to respiratory problems and cause unhealthy air advisories in Iowa. NO_X, when reacting with volatile organic compounds in sunlight, forms ground-level ozone, or 'smog." Ground-level ozone causes respiratory problems.

Table 20: Electric Power Industry Emissions Estimate 1990, 2000, 2006

Emission Type / Fuel	1990 (thousand metric tons)	2000 (thousand metric tons)	2006 (thousand metric tons)
Sulfur Dioxide (SO_2)			
Coal	182	148	131
Petroleum	*	1	1
Natural Gas	*	*	*
Other	*	*	*
Total	183	149	132
Nitrogen Oxide (NO_X)			
Coal	151	85	61
Petroleum	*	*	1
Natural Gas	1	1	1
Other	*	*	1
Total	152	87	64

* Value is less than 0.5

Mercury is another pollutant tied to the energy-sector. According to U.S. Environmental Protection Agency, more than 40% of all mercury emissions in the U.S. come from coal-fired power plants. Mercury accumulates in the tissue of fish and other aquatic animals and persists in the environment. It can cause serious neurological damage to developing fetuses, infants and children even at low levels.

In addition to the potentially devastating radiation effects of an accident at a nuclear power plant, the highly radioactive waste generated by nuclear power facilities poses a serious environmental threat. The Duane Arnold nuclear reactor in Iowa is expected to have produced 467 metric tons of high-level radioactive waste by 2011, but no permanent storage facility for this waste exists.

Impacts of Renewable Energy Production

While utilizing renewable resources for energy production has many environmental benefits, renewable energy is not without impacts on the natural resources of the state.

Environmental costs and benefits of ethanol have been widely debated. This is the case for corn-based ethanol in particular. The production of corn itself has significant environmental impacts, including soil erosion from intensive row-crop farming, nutrient loading from fertilizer, and contamination of water and soil from pesticide use. Increased corn acreage to supply Iowa's growing ethanol industry may exacerbate these problems. Ethanol facilities themselves often discharge sediment- and nutrient-rich water into Iowa's water bodies. A recent concern is the effect of ethanol industry on water quantity. Until now, water quantity has not been a serious issue in Iowa. However, fast growing biofuels industry appears to have the potential to significantly impact water supplies at the local level. Biofuel refineries are most often fueled by natural gas and coal, which generate carbon dioxide and other air pollutants such as NOx, SO_2 and mercury. Due to significant fossil fuel inputs in corn production and at ethanol facilities, U.S. Department of Energy estimates that the use of corn-based ethanol can reduce overall greenhouse gas emissions only by 18-28 % compared to gasoline. Cellulosic ethanol is estimated to reduce GHG emissions by 87 %.

The most controversial environmental issue regarding wind energy has been the impact of wind turbines on bird populations. Most of the controversy stems from an early wind farm in California that experienced high levels of avian mortality. Studies in other areas, including Iowa, have not shown significant impacts on avian populations. It is also standard practice for wind farm developers to conduct avian impact studies to avoid areas that pose a risk for significant avian impacts. A more recent area of concern has been the impact of wind turbines on bats. For example, an Iowa State University study on bird and bat mortality associated with the Top of Iowa Wind Farm from August 2002 to August 2005 found minimal impact on birds in the region, but bat mortality was found to be "substantial." Study authors recommended that more research should be conducted on bat behavior and mortality at wind farms. "Visual pollution" from wind turbines is mostly a question of esthetics, and it has not come up as a serious problem in Iowa.

F. Evaluation of renewable energy sources, including the current and future technological potential for such sources.

Earlier portions of this report include information about the consumption and composition of renewable energy in Iowa. As indicated in Graph 14, biomass is the most consumed form of renewable energy in Iowa. In 2004, 53% of Iowa's renewable energy consumption came from biomass. The rest of the renewable energy consumption consisted in nearly equal shares of hydroelectric energy (15%), ethanol (15%) and "other" forms of renewable energy (17%). In Iowa, the category of "other" renewable energy comprises mainly of wind energy.

Biomass

Biomass is the most consumed form of renewable energy in Iowa, comprising 53% of Iowa's renewable energy consumption in 2004. The industrial sector accounted for 77 % of the total biomass consumption in 2004. Use of biomass declined steadily prior to 2001, but has slightly increased since 2002. As detailed in Graph 21, the linear regression model predicts Iowa's biomass consumption to decline in the future. However, increased use of biomass between 2002 and 2004 may indicate a reversal of a long-term declining trend in biomass consumption. It is also likely that public policies affecting the utilization of biomass will likely have a great effect on future development and use of biomass technologies in the state.

Hydro

Iowa's hydroelectric capacity was 131 MW in 2004. Due to minimal changes in Iowa's hydroelectric capacity, its use in the state has remained relatively stable for many years. Potential to significantly increase Iowa's hydroelectric capacity is limited.

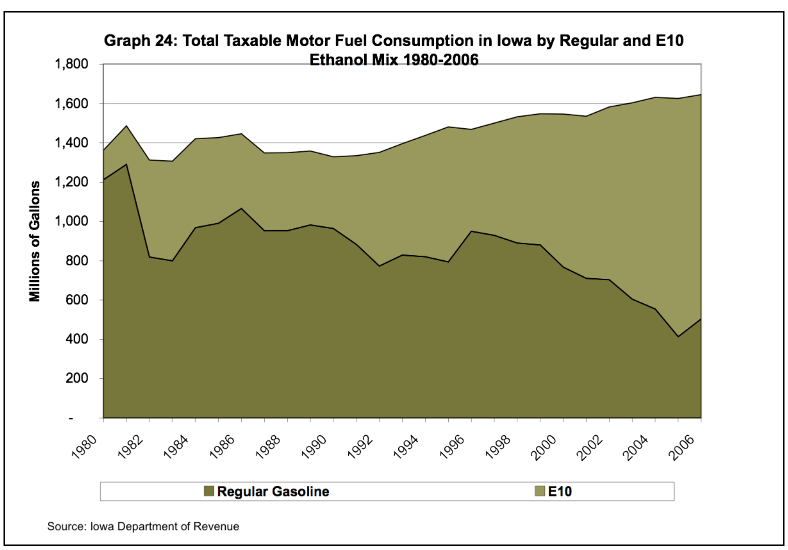
Biofuels

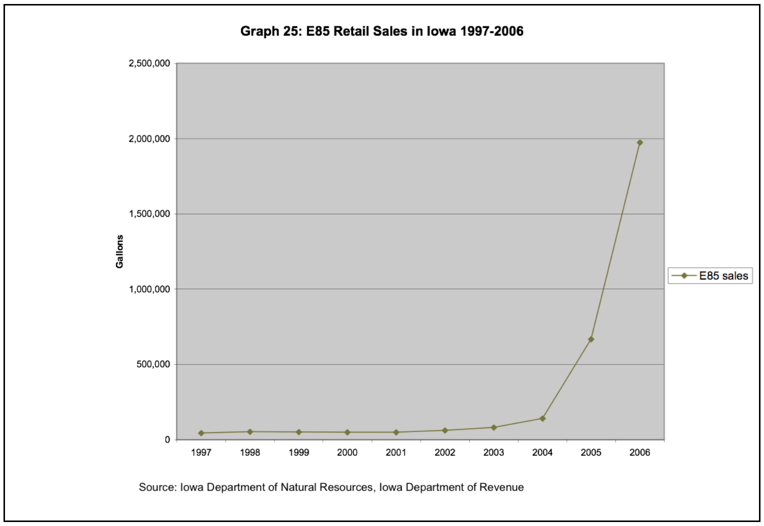
Iowa is the leading producer of both ethanol and biodiesel in the nation. Table 21 includes Iowa's current production capacity and capacity under construction for both ethanol and biodiesel. The data is based on figures provided by the Iowa Renewable Fuels Association as of December 2007. Iowa is clearly a net exporter of both ethanol and biodiesel. Based on information from the U.S. Department of Energy, Energy Information Administration, approximately 113 million gallons of ethanol was consumed in Iowa in 2004. No comparable sales data for biodiesel is available.

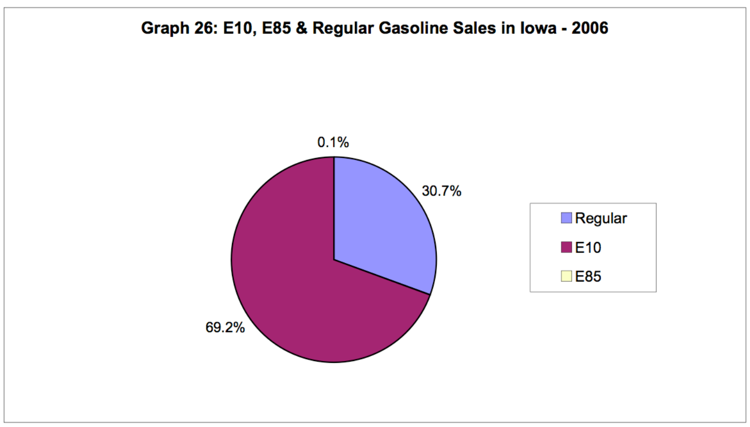
Table 21: Iowa Ethanol and Biodiesel Capacity, December 2007

Fuel	**Current Capacity (million gallons)**	**Under Construction (million gallons)**
Ethanol	1,975.5	1,360
Biodiesel	257.5	95

Ethanol is sold in Iowa as a 10 % blend (E10) and 85 % blend (E85). Retail sales of ethanol blended gasoline have increased steadily over the last several years, as illustrated in Graphs 24 and 25. Sales of E85 blend have skyrocketed in the last few years, from approximately 140,000 gallons in 2004 to nearly 2 million gallons in 2006. This rapid growth can be attributed to the increased availability of the fuel due to more numerous retail outlets offering the product. Despite this growth in sales, in 2006 E85 blend accounted for only 0.1 % of all gasoline retail sales in Iowa. A noteworthy detail in Graph 24 is the dip in E10 sales in 2006. This was due to a significant drop in E10 sales for a short time during the summer of 2006. This sales drop coincided with the price of E10 blend being temporarily higher than regular gasoline.

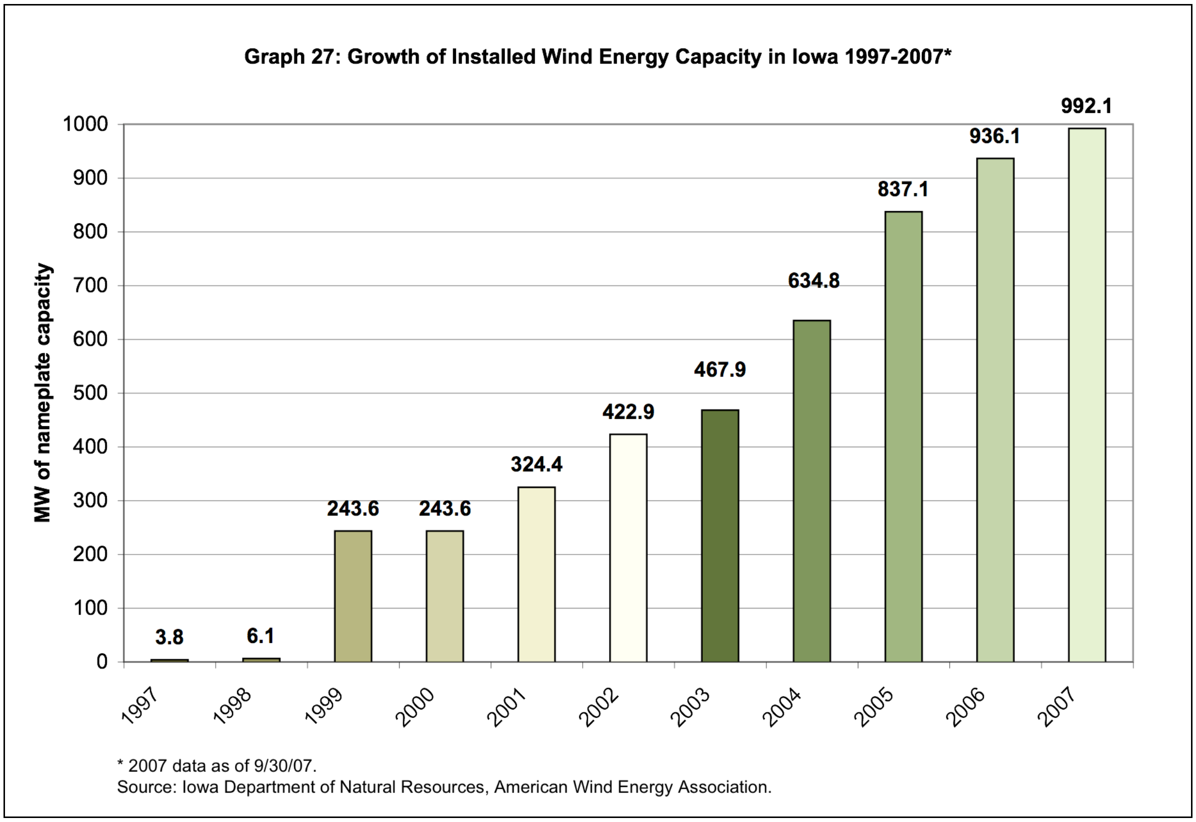






Wind Energy

As of September 2007, Iowa had 992 MW of installed nameplate capacity of wind energy. This ranked Iowa third among all states, trailing only the much larger states of Texas and California. Graph 27 details the rapid expansion of wind energy capacity in Iowa since the late 1990's. Most of Iowa's existing wind energy capacity has been developed by large investor-owned utilities and out-of-state wind energy developers. Of the 992 MW wind energy capacity in Iowa, approximately 50 MW is considered "community wind" – a term that refers to wind projects where one or more members of local community have a significant financial stake. Rapid growth in wind energy is expected to continue in Iowa. According to the American Wind Energy Association, over 380 MW of wind energy capacity was under construction in Iowa as of September 2007. An important factor in further development of wind energy in Iowa, and many other states, is the need to ensure that adequate transmission capacity exists to transmit wind-generated electricity to load centers.



Renewable Energy Potential

In September 2005, the DNR Energy Section received a report assessing Iowa's renewable resource potential. Prepared at the Energy Section's request by the U.S. DOE National Renewable Energy Laboratory (NREL), this is an assessment of the technical potential for energy derived from renewable sources, not an assessment of the practical economics. According to the report, Iowa has the technical potential to develop from 14,000 MW to 165,000 MW of renewable energy capacity. In addition to the technical potential estimates, the report also includes general information on the costs of renewable generation sources.

Table 22, from the NREL report, presents data on the several renewable energy resources that have been installed in Iowa and their potential for further development, along with summarized data on the capital and levelized costs of renewable energy generation facilities. The NREL report concludes that, in light of resource availability and cost, Iowa has the greatest potential to develop wind and biomass resources. While landfill gas generators are among the lowest cost renewables, there are limited resources to develop in Iowa. There is ample solar resource to support significant levels of solar photovoltaic energy on existing rooftops, but at a higher cost than the other renewables.

The study determined that Iowa has wind resources adequate for utility-scale wind projects within 10 miles of transmission to support 155,000 MW of electric generating capacity. Because existing transmission lines may only be partially available for wind generation, assuming 20% availability of existing transmission lines resulted in a technical potential estimate of 5,500 MW of wind generating capacity. Regarding biomass resources, crop residues have the technical potential to support about 1,500 MW of electric generation, while urban wood residues and forest residues could support another 150 MW. In addition, dedicated energy crops of poplar and switchgrass could potentially support approximately 1,600 MW of electric generation, and farm-based methane resources and landfill gas methane resources could support another 110 MW.

Table 22: Summary of Iowa Renewable Resources - Potentials and Costs

Technology	Iowa Installed - 2005	Iowa Technical Potential MW	Capacity Factor	Capital Cost $/kW	Real LCOE $/MWh	Iowa Potential
Wind	637 MW	5,500-155,000	30-38%	$1,187	$35-$69	Good
Solar PV	0.1 MW	5,400-6,100	14-20%	$4,678	$235-$448	Moderate
Biomass (direct)	4.9 MW	3,250	83%	$1,842	$46-$56	Good
MSW/Landfill gas	32.2* MW	15	90%	$1,571	$30-$39	Limited
TOTAL	674.2 MW					

* Includes municipal solid waste combustion, and landfill gas-to-electricity generation facilities.

Reference List:

American Council for an Energy-Efficient Economy, "Role of Energy Efficiency and Onsite Renewables in Meeting Energy and Environmental Needs in the Dallas/Fort Worth and Houston/Galveston Metro Areas," September 2007

(http://aceee.org/pubs/e078.pdf)

American Council for an Energy-Efficient Economy, "The Economic Benefits of an Energy Efficiency and Onsite Renewable Energy Strategy to Meet Growing Electricity Needs in Texas," September 2007

(http://aceee.org/pubs/e076.pdf)

Bedzek, Roger H., Management Information Services, Inc., "Economic and Jobs Impacts of the Renewable Energy and Energy Efficiency Industries: U.S. and Ohio," July 2007

(http://www.ases.org/jobs_report.pdf)

Environment Iowa Research & Policy Center: "Redirecting Iowa's Energy," 2006 (http://www.uspirg.org/uploads/tI/zy/tIzyfu9jHWqyL5dwI52ZHQ/Redirecting_Iowas_Energy.pdf)

Iowa Renewable Fuels Association website, September 2007. Ethanol facility information: http://www.iowarfa.org/ethanol_refineries.php Biodiesel facility information: http://www.iowarfa.org/biodiesel_refineries.php

Iowa State University, Department of Economics: "Analysis of Energy Supply and Usage in the Iowa Economy," December 2005

(http://www.iowadnr.com/energy/info/files/economy.pdf)

Koford, Rolf R., Jain, Aaftab, "Bird and Bat Mortality Associated with the Top of Iowa Wind Farm," August 2005, (http://www.ag.iastate.edu/centers/cfwru/projects/completed/WindFarm2005.pdf)

Union of Concerned Scientists, "Cashing In on Clean Energy," 2007

(http://www.ucsusa.org/clean_energy/clean_energy_policies/cashing-in.html)

University of Northern Iowa, Center for Energy and Environmental Education, "Year 2000 Iowa Greenhouse Gas Emissions Inventory," January 2005

(http://www.iowadnr.com/energy/news/files/greenhouse.pdf)

University of Tennessee, Department of Agricultural Economics, "25% Renewable Energy for the United States by 2025: Agricultural and Economic Impacts," November 2006

(http://www.agpolicy.org/ppap/REPORT%2025x25.pdf)

Urbanchuk, John M., LECG LLC: "Contribution of the Biofuels Industry to the Economy of Iowa," February 2007 (http://www.iowarfa.org/PDF/2006%20Iowa%20Biofuels%20Economic%20Impact.pdf)

U.S. Department of Energy, Energy Information Agency: "State Energy Data 2004: Consumption" (http://www.eia.doe.gov/emeu/states/sep_use/total/pdf/use_ia.pdf)

U.S. Department of Energy, Energy Information Agency: "State Electricity Profiles 2006, Iowa" (http://www.eia.doe.gov/cneaf/electricity/st_profiles/iowa.html)

U.S. Department of Energy, National Renewable Energy Laboratory, "Iowa Renewable Resource Assessment," September 2005

(http://www.iowadnr.com/energy/renewable/files/05rra.pdf)

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