







# **Iowa's Energy Profile:** Energy Supply, Demand and Sector Employment

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### lowa seeks to:

- Develop a detailed profile of energy in lowa.
- Identify trends likely to effect the impact of energy on the lowa economy.
- Understand key assets across the energy value chain.
- Identify opportunities to generate technology-based economic development through R&D and commercialization of energy innovations.
- Identify opportunities to conserve energy and reduce any negative externalities associated with energy development, generation or use.
- Develop an integrated strategy to maximize energysector benefits for the lowa economy.



### Multiple pathways for lowa energybased economic development.

Exploit natural fuel/resource assets to generate cost-effective power.

Export fuels or energy, and higher value-added liquid fuels, chemicals or materials.

Pathways to Energy Economic Development Perform R&D focused on energy and associated technologies, attracting external research funds.

Leverage research assets to develop new energy products, technologies and services for sale in the domestic and international marketplace.

Expand manufacturing sector producing energy technologies.

Energy conservation/efficiency to increase energy resource availability for export, reduce imports, generate jobs and lessen environmental impacts.

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#### **Energy Production and Distribution Value Chain**



### **The Starting Point for the Project**

Phase I:

Examining energy supply and demand in lowa, and employment in the energy sector value chain.





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### **Iowa's Energy Profile - Production**

Total Energy	lowa Consumption	lowa Production	Difference (imports)
	1,516.5 trillion Btu	730.5 trillion Btu	786 trillion Btu

**Conclusion 1:** Iowa currently <u>consumes</u> more raw energy than it produces, and <u>imports</u> more raw energy than it produces.

Thus, from a basic economic policy standpoint, increasing energy production in Iowa will enhance Iowa's balance of trade and benefit the Iowa economy. Similarly, investments in energy efficiency will have benefits in terms of Iowering the leakage of funds outside of the state that pay for imported energy.



### **Iowa's Energy Profile - Production**

Iowa has a less diversified production profile than the U.S.



<u>Conclusion 2:</u> Without a significant base of fossil resources, lowa has to currently import more than 2x the raw energy than it produces. <u>Investment in</u> <u>renewable energy</u> is significantly improving the balance of energy equation.

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### Iowa's Energy Profile – <u>Electricity</u> Production

Total **electric** power generation in Iowa has increased significantly since 2001 growing from 40.7 million MWh in 2001 to 56.9 million MWh in 2014.

Electricity Generation Source	2001 Megawatt-hours of Production	2014 Megawatt- hours of Production	Percent Change 2001-2014	Percent of 2014 Iowa Electricity Generated by this Source
TOTAL	40,659,000	56,875,000	39.9%	100.0%
Coal	34,665,000	33,733,000	-2.7%	59.31%
Wind	488,000	16,307,000	3,241.6%	28.67%
Nuclear	3,853,000	4,152,000	7.8%	7.30%
Natural Gas	593,000	1,373,000	131.5%	2.41%
Hydroelectric	845,000	879,000	4.0%	1.55%
Biomass	104,000	266,000	155.8%	0.47%
Petroleum Liquids	99,000	59,000	-40.4%	0.10%
Petroleum Coke	4,000	85,000	2,025%	0.15%
Solar (Distributed and	0	21,000		0.04%
Utility)				
Other	8,000	0		0.00%

Conclusion 3: Since 2001 lowa has increased its electric power generation by 39.9%. The vast majority of this new generation has come in the form of wind-power. The net effect has been a significant decrease in the overall percentage of lowa's electricity generated by fossil fuels which declined from 87% in 2001 to 62% in 2014.

lowa's economy is <u>more industrially-intensive</u> than the U.S. economy overall. Iowa accounts for 2.4% of the U.S. industrial energy consumption but only 1.0% of the U.S. population.



Consumption (Btu) Share by End Use Sector, 2013



#### **Energy Consumption Metrics by End Use Sector, 2013**

	lowa		U.S.		
	2013	Percent	2013	2013	Percent
	Consumption	Change,	Share of	Consumption	Change,
Sector	(Billion Btu)	2000-2013	U.S.	(Billion Btu)	2000-2013
Residential	253,709	7.1%	1.2%	21,181,996	3.9%
Commercial	215,696	24.8%	1.2%	17,894,337	4.2%
Industrial	747,332	46.3%	2.4%	31,378,925	-9.5%
Transportation	299,747	10.5%	1.1%	26,689,441	0.5%
<b>Total Energy Consumption</b>	1,516,483	27.2%	1.6%	97,144,709	-1.7%

<u>Conclusion 4:</u> Iowa's energy consumption grew moderately between 2000-2013, while the U.S. saw energy consumption decline.



<u>lowa uses renewable energy to a much greater degree</u> than the nation, but also uses more coal. It is less reliant than the U.S. overall in the use of natural gas, gasoline and other petroleum, and nuclear power.



Production Share (Btu) by Major Source Category, 2013



### lowa's changing energy consumption mix





#### **Energy Consumption Metrics by End Use Sector, 2013**

	lowa			U.S.		
Sector	2013 Consumption (Billion Btu)	Percent Change, 2000-2013	2013 Share of U.S.	2013 Consumption (Billion Btu)	Percent Change, 2000-2013	
Coal	402.4	-9.8%	2.2%	18,038.8	-20.1%	
Fuel Oil	138.9	23.9%	1.7%	8,066.4	1.8%	
Gasoline	198.7	3.7%	1.2%	16,338.6	1.1%	
All Other Petroleum	76.5	-18.2%	0.7%	10,323.2	-27.2%	
Natural Gas	306.5	50.9%	1.1%	26,801.8	12.5%	
Nuclear	55.6	19.7%	0.7%	8,244.4	4.9%	
Renewable Energy	384.7	376.5%	4.2%	9,147.6	49.8%	
Net Interstate Flow of Electricity (Export)	(46.8)	354.1%	N/A	N/A	N/A	
<b>Total Energy Consumption</b>	1,516.5	27.2%	1.6%	97,144.7	-1.7%	

<u>Conclusion 5:</u> Iowa changes in consumption by energy type have been quite different that the U.S. overall. Very large differential in use of renewables.



### Iowa's Energy Profile - Expenditures

lowa's **expenditure** profile in for energy is similar to the U.S. The main difference, again, is that lowa spends a higher percent of its total energy dollars on industrial use (25.5%) versus the nation (17%).



#### **Energy Expenditures Share (\$ millions) by End Use Sector, 2013**



### Iowa's Energy Profile - Expenditures

#### **Energy Expenditure Metrics by End Use Sector, 2013**

	lowa		U.S.			
<b>O</b> r oto r	2013 Expenditures (\$ millions)	Percent Change, 2000-2013	Share	2013 Expenditures (\$ millions)	Percent Change, 2000-2013	
Sector	(\$ mmons)	2000-2013 E1 90/	01 U.S.		2000-2013	
Residential	\$2,755.5	00.0%	1.1%	\$250,457.4	01.3%	
Commercial	\$1,965.2	88.9%	1.1%	\$179,359.6	58.1%	
Industrial	\$4,395.5	90.3%	1.9%	\$233,272.3	65.3%	
Transportation	\$8,149.2	169.8%	1.1%	\$712,216.5	156.2%	
Total Energy Consumption	\$17,265.4	110.9%	1.3%	\$,1375,305.9	100.0%	

All consumption categories increased faster in Iowa than they did in the nation, except for residential.



### Iowa's Energy Profile - Expenditures

#### **Energy Expenditure Metrics by End Use Sector, 2013**

	lowa			U.S.	
Sector	2013 Expenditures (\$ millions)	Percent Change, 2000-2013	Share of U.S.	2013 Expenditures (\$ millions)	Percent Change, 2000-2013
Primary Use Fuels	\$13,490.4	129.9%	1.3%	\$1,003,224.6	119.9%
Coal	\$178.7	85.2%	2.6%	\$6,765.4	85.1%
Natural gas	\$1,988.7	38.9%	1.7%	\$114,752.9	20.8%
Motorgasoline	\$5,580.8	148.6%	1.2%	\$467,337.6	143.2%
Fuel oil	\$3,735.7	249.5%	1.7%	\$220,156.5	185.9%
LPG or propane	\$1,398.4	85.2%	2.5%	\$55,690.0	99.1%
All other petroleum products	\$575.6	121.1%	0.4%	\$131,898.7	129.6%
Biomass (Wood & waste)	\$32.6	229.3%	0.5%	\$6,779.9	136.4%
Retail Electricity All Fuels & Sources incl. Nuclear and Renewable	\$3,775.0	62.8%	1.0%	\$372,081.3	60.7%
Total Energy Consumption	\$17,265.4	110.9%	1.3%	\$,1375,305.9	100.0%

<u>Conclusion 6:</u> Iowa's total expenditures for energy have increased at a rate 10.9% over expenditures in the nation between 2000 and 2013.



### Iowa's Energy Profile - Electricity

In terms of **electricity consumption**, lowa's industrial sector consumes a considerably higher percent (42% of all electricity in the State) than does the nation overall (26.3%).



#### Electricity Consumption (Btu) by End Use Sector, 2013



### **Iowa's Energy Profile - Electricity**

#### **Electricity Consumption Metrics by End Use Sector, 2013**

	lowa		U.S.		
	2013	Percent	2013	2013	Percent
	Consumption	Change,	Share of	Consumption	Change,
Sector	(Billion Btu)	2000-2013	U.S.	(Billion Btu)	2000-2013
Residential	50,004	21.8%	1.1%	4,759,464	17.0%
Commercial	42,510	25.4%	0.9%	4,586,432	15.9%
Industrial	67,020	14.7%	2.0%	3,338,133	-8.1%
Transportation	0	0.0%	0.0%	26,017	41.7%
<b>Total Energy Consumption</b>	159,534	19.6%	1.3%	12,710,046	8.9%

Industrial electricity consumption grew in Iowa but declined in the U.S. overall. Commercial consumption grew in Iowa more than in the U.S., as did residential.



## Iowa's Energy Profile - Benchmarks

Comparing Iowa's energy consumption to national overall statistics provides a useful perspective, but so too does comparing Iowa's energy consumption to the six states that border Iowa.



#### **Energy** <u>Consumption</u>, Iowa and Benchmark States, 2013

State	Total Energy Consumption (Million Btu)	Rank	Total Energy Consumption (Million Btu) per Capita	Rank Energy Consumption Intensity of GSP*		Rank
lowa	1,516,483	24	490	5	9.98	11
Illinois	4,011,485	4	311	25	5.96	31
Minnesota	1,859,790	18	343	18	6.54	28
Missouri	1,857,005	19	307	26	7.21	22
Nebraska	871,805	33	466	7	8.85	18
South Dakota	390,367	45	462	8	9.86	13
Wisconsin	1,804,018	21	314	24	5.38	38

\*Note: Energy Consumption Intensity of GSP is calculated as total energy consumption as percent of current-dollar GDP.



### Iowa's Energy Profile - Benchmarks

#### **Energy Expenditures, Iowa and Benchmark States, 2013**

State	Total Energy Expenditures (\$ million)	Rank	Total Energy Expenditures per Capita (S)	Rank	Energy Expenditure Intensity of GSP*	Rank
lowa	\$17,265.4	28	\$5,583.3	7	10.35	20
Illinois	\$49,296.6	7	\$3,824.2	39	6.80	43
Minnesota	\$24,689.5	20	\$4,553.5	22	8.03	35
Missouri	\$26,721.7	17	\$4,420.5	25	9.65	24
Nebraska	\$10,293.8	35	\$5,507.7	9	9.41	25
South Dakota	\$4,708.9	47	\$5,569.3	8	10.54	18
Wisconsin	\$24,715.9	19	\$4,303.7	30	8.68	30

\*Note: Energy Expenditure Intensity of GSP is calculated as total energy expenditures as percent of current-dollar GSP.

<u>Conclusion 7:</u> For lowa, undertaking a state energy strategy is particularly important since <u>energy consumption and expenditure per</u> <u>capita is higher than it is in surrounding states</u>, as is (generally) the intensity of energy use as measured as a percentage of state GSP.



# The Energy Sector as an Employment Generator in Iowa



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NAICS		
Code	Industry Title	Energy SubsectorSubsector
325190	Other Organic Chemicals	Biodiesel Production
325193	Ethyl Alcohol Manufacturing	Ethanol Production
211111	Crude Petroleum and Natural Gas Extraction	Extraction/Resource Development
211112	Natural Gas Liquid Extraction	Extraction/Resource Development
212111	Bituminous Coal and Lignite Surface Mining	Extraction/Resource Development
213111	Drilling Oil and Gas Wells	Extraction/Resource Development
213112	Support Activities for Oil and Gas Operations	Extraction/Resource Development
213113	Support Activities for Coal Mining	Extraction/Resource Development
424710	Petroleum Bulk Stations and Terminals	Petroleum Products & Wholesale
424720	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)	Petroleum Products & Wholesale
454311	Heating Oil Dealers	Petroleum Products & Wholesale
454312	Liquefied Petroleum Gas (Bottled Gas) Dealers	Petroleum Products & Wholesale
454319	Other Fuel Dealers	Petroleum Products & Wholesale
333611	Turbine and Turbine Generator Set Units Manufacturing	Other Renewable Energy & Storage
335911	Storage Battery Manufacturing	Other Renewable Energy & Storage
335912	Primary Battery Manufacturing	Other Renewable Energy & Storage
221111	Hydroelectric Power Generation	Power Generation
221112	Fossil Fuel Electric Power Generation	Power Generation
221113	Nuclear Electric Power Generation	Power Generation
221119	Other Electric Power Generation	Power Generation
221121	Electric Bulk Power Transmission and Control	Power Transmission/Distribution
221122	Electric Power Distribution	Power Transmission/Distribution
221210	Natural Gas Distribution	Power Transmission/Distribution
221330	Steam and Air Conditioning Supply	Power Transmission/Distribution
237120	Oil and Gas Pipeline and Related Structures Construction	Power Transmission/Distribution
237130	Power/Communication Line and Related Structures Construction	Power Transmission/Distribution
335311	Power, Distribution, and Specialty Transformer Manufacturing	Power Transmission/Distribution
486110	Pipeline Transportation of Crude Oil	Power Transmission/Distribution
486210	Pipeline Transportation of Natural Gas	Power Transmission/Distribution
486910	Pipeline Transportation of Refined Petroleum Products	Power Transmission/Distribution
486990	All Other Pipeline Transportation	Power Transmission/Distribution
324110	Petroleum Refineries	Refineries

Eight clusters of multiple NAICS industries make up the Iowa Energy Sector.

- Biodiesel production
- Ethanol Production
- Extraction and Resource Development
- Other Renewable Energy and Storage
- Petroleum Products
  and Wholesale
- Power Transmission and Distribution
- Power Generation
- Refineries.



# Iowa's Energy Profile - Employment

The lowa energy cluster consists of 849 establishments, with a combined employment of 16,292.

Iowa Establishments, Employment and Location Quotients for the Total Energy Cluster and Individual Subclusters, 2014

Energy Subcluster	lowa Estabs. 2014	lowa Employ., 2014	IA Location Quotient, 2014	Iowa Employ. % Change, 2001–14	U.S. Employ. % Change, 2001–14
Total Energy Cluster	849	16,292	0.78	22.2%	18.6%
Power Transmission/ Distribution	428	7,011	0.88	-2.8%	25.6%
Other Renewable Energy & Storage	12	2,606	4.42	143.6%	-7.7%
Power Generation	99	2,520	1.41	-5.1%	-42.3%
Ethanol Production	40	1,845	15.71	3,838.6%	225.1%
Petroleum Products and Wholesale	242	1,699	0.88	-22.3%	-20.5%
<b>Biodiesel Production</b>	14	550	1.37	310.4%	-5.2%
Refineries	3	39	0.05	254.5%	-7.6%
Extraction/Resource Development	11	22	0.00	161.7%	91.7%
Total Private Sector	93,351	1,280,079	1.00	6.5%	5.5%
Total Manufacturing	4,048	216,834	1.61	10.0%	-25.8%

## Iowa's Energy Profile - Employment

The **<u>overall</u>** lowa energy cluster is currently under-concentrated in lowa and therefore not seen as a state "specialization" (when aggregated).

Employment <u>is highly concentrated</u> among several key energy subclusters, with four – ethanol production (LQ=15.71), other renewable energy & storage (LQ=4.42), power generation (LQ=1.41) and biodiesel production (LQ=1.37) each rising to the level of state "specializations."

<u>Conclusion 8:</u> Though the energy cluster overall is a currently not a specialized industry for lowa, distinct niches exist within lowa that show significant growth and specialization. In addition, the energy sector has been a significant job generator, far outpacing overall private sector growth.



## **Iowa's Energy Profile - Employment**

**Total Energy Cluster Employment Trends for Iowa and the U.S., 2001-2014** 



<u>Conclusion 9:</u> The Iowa Energy sector has seen significant net growth in employment since 2001, performing at the same level as the U.S. Energy sector and outperforming Iowa's overall private sector.

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### Iowa Energy Size, Growth, and Specialization (LQ) by Subcluster, for 2001-2014



### Performance of Large & Specialized (LQ ≥ 1.20) Detailed Iowa Energy Sectors, 2001 - 2014

		Establishments		Employr		
Energy Subcluster	NAICS Description	Number, 2014	Growth, 2001-2014	Jobs, 2014	Growth, 2001-2014	LQ 2014
Ethanol Production	Ethyl Alcohol Manufacturing (325193)	40	1100.0%	1,845	3838.6%	15.71
Other Renewable Energy & Storage	Turbine and Turbine Generator Set Units Manufacturing (333611)	8	220.0%	1,896	728.5%	6.37
Power Generation	Fossil Fuel Electric Power Generation (221112)	77	-33.0%	1,759	-24.7%	1.60
Power Transmission	Electric Power Distribution (221122)	145	17.6%	2,846	-19.2%	1.26
and Distribution	Power/Communication Line and Related Structures Construction (237130)	158	41.1%	2,202	112.8%	1.20

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### **Iowa's Energy Profile - Wages**

Industry Cluster, Subcluster, or Sector	lowa Average Wages, 2014	U.S. Average Wages, 2014	IA Wage Share of U.S. Wage	
Power Generation	\$102,264	\$111,298	92%	
Power Transmission/Distribution	\$80,135	\$87,232	92%	
Mgmt. of Companies & Enterprises	\$77,959	\$112,868	69%	
Total Energy Cluster	\$73,254	\$96,468	76%	
Finance & Insurance	\$68,456	\$97,373	70%	Average
Professional, Scientific, & Tech. Srvs.	\$60,472	\$86,391	70%	Wages for
Refineries	\$60,158	\$132,020	46%	Select
Manufacturing	\$54,418	\$62,977	86%	lowa and
Construction	\$51,934	\$55,040	94%	
Extraction/Resource Development	\$51,191	\$109,875	47%	0.5.
Information	\$50,764	\$90,804	56%	Industries,
Other Renewable Energy & Storage	\$49,907	\$73,100	68%	2014
Petroleum Products & Wholesale	\$45,693	\$63,903	72%	
Transportation & Warehousing	\$42,047	\$48,720	86%	
Ethanol Production	\$41,964	\$74,758	56%	
Total Private Sector	\$41,964	\$51,298	82%	
Health Care & Social Assistance	\$39,605	\$45,859	86%	
Retail Trade	\$24,673	\$28,743	86%	

<u>Conclusion 11:</u> The energy cluster in lowa pays higher wages in comparison to the overall private sector. It provides the sort of high quality, family-sustaining jobs that economic developers seek to grow.

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# Iowa's Energy Profile - Productivity

In terms of labor productivity, measured by value-added per worker, lowa **lags behind** the nation with the lowa energy sector producing \$193,326 in value-added activity per employee, versus \$263,028 for the nation.

With lowa's energy productivity level running at about 74% of the national level, taking into account the fact that lowa energy wages are, on average, only 76% of the national level, <u>it is evident that the lowa workforce is</u> <u>effectively still good value for money.</u>

Industry Cluster	Iowa Productivity, 2014	U.S. Productivity, 2014	lowa Productivity Share of U.S. Productivity			
Energy Cluster	\$193,326	\$263,028	74%			
Total Private Sector	\$88,548	\$93,915	94%			

#### Value-Added per Worker in the Energy Cluster, 2014 —Iowa Compared to the U.S.

