IOWA ENERGY PLAN

IOWA economic development

IOWA DOT

Purpose of the Meeting

- Provide an Update on Stakeholder Input
- Communicate Next Steps in the Process
- Review / Discuss Consultant Deliverables

Agency / Organization Meetings

OBJECTIVES

- Gather information on energy policies and programs
- Gain understanding of how energy plan might address/support their needs

OUTCOME

39 meetings with state agencies and stakeholder organizations

Takeaways from Agency Meetings:

- **Lead by Example**
  - **“Practice what plan might encourage” Agencies embracing energy efficiency; bulk purchasing of alternative fuel vehicles, etc.**
- **Economic Development via Innovation**
  - **Opportunity for further agency collaboration with universities and private sector to support research and development in the energy space**
- **Collaboration**
  - **Coordination amongst state agencies to stay informed; provide shared support; break down silos, etc.**

Public Forums

MARCH	TUESDAY 29 Ames	WEDNESDAY 30 Storm Lake	THURSDAY 31 Council Bluffs
APRIL	TUESDAY 12 Ottumwa	WEDNESDAY 13 Cedar Rapids	THURSDAY 14 Dubuque

Public Forums

OBJECTIVES

- Communicate the plan development process
- Share findings from the assessment of Iowa's Energy Position
- Allow the public to provide input on energy in Iowa
- Identify areas of interest or concern
- Identify best practices

OUTCOME

Six public forums attended by 217 individuals

Over 100 public comments received

Takeaways from Public Forums:

- **Mandates vs. Incentives**
  - Preference of a carrot vs. stick in terms of outcomes of the energy plan
- **Diversity of Energy Resources**
  - Some pushed for 100% renewable energy
  - Others support renewables, but caution that a diverse portfolio be maintained to ensure affordability and reliability
- **Support vs. Concerns of Exporting Energy Resources**
  - Some support export of excess power capacity out-of-state for economic development benefits
  - Others do not like the movement of Iowa's energy resources across and ultimately out-of-state

Working Groups

OBJECTIVES

- Share expertise around topic areas
- Identify opportunities and issues
- Assist in the development of a vision statement and guiding principles
- Develop objectives and strategy recommendations

OUTCOME

Participation by **48 individuals**

Five facilitated in-person meetings per working group

Collaboration via an **online platform**

Public access to meetings via webinar and website access to materials

Takeaways from Working Groups:

- **Build Upon Iowa's Leadership in Renewable Energy**
  - Continue development of renewable energy at both utility and localized/distributed levels
  - Business development opportunities for companies seeking not only affordable / reliable energy, but also those wanting to be powered by renewable sources
- **Diversity of Energy Resources**
  - Similar to public comments- Some support 100% renewables; others aren't opposed to renewables but caution that diverse portfolio needs maintained for affordability and reliability
  - Not all utilities created equal

Takeaways from Working Groups:

- **Robust Infrastructure System**
  - Evaluate potential barriers to energy transmission and pipeline projects
  - Explore ideas (public/private partnerships) to further build out natural gas delivery system, particularly in rural areas
  - Interconnected transportation system to optimize movement of goods and people; minimize cost; improve travel time; enhance safety; improve supply chain efficiencies, etc.
- **Education / Training / Workforce Development**
  - Need to increase local talent pool for local energy related careers

Vision Statement

Iowa is committed to the development of an affordable, reliable and sustainable energy system that maximizes economic benefits for our state.

We will continue to embrace energy efficiency, a mix of energy resources, infrastructure, and technologies to position all of Iowa – both rural and urban – for future growth.

As a clean energy leader, our efforts will drive innovation, foster research and development, create business and career opportunities and promote environmental stewardship.

Guiding Principles

The objectives and strategies put forth in the Iowa Energy Plan will:

- Foster long-term energy affordability and price stability for Iowa's residents and businesses
- Increase the reliability, resiliency, safety and security of Iowa's energy systems and infrastructure
- Stimulate research and development of new and emerging energy technologies and systems
- Provide predictability by encouraging long-term actions, policies and initiatives

Continued on next page.

Guiding Principles

The objectives and strategies put forth in the Iowa Energy Plan will:

- Expand opportunities for access to resources, technologies, fuels and programs throughout Iowa in a manner that results in a fair and balanced outcome for all customers
- Seek diversity in the resources that supply energy to and within Iowa while preserving fair and reasonable costs for customers
- Support alternative energy resources, technology, and fuel commercialization in proven, cost-effective applications
- Encourage sector-based workforce development and educational activities that build clear pathways to rewarding energy careers
- Promote the protection of the environment and Iowa's natural resources

Next Steps in the Process:

- Consultant partners will conduct economic modeling early plan drafting

- Planning updates to be provided to IPEP at October 6 meeting

Simon Tripp
Principal and Senior Director
TEConomy Partners, LLC

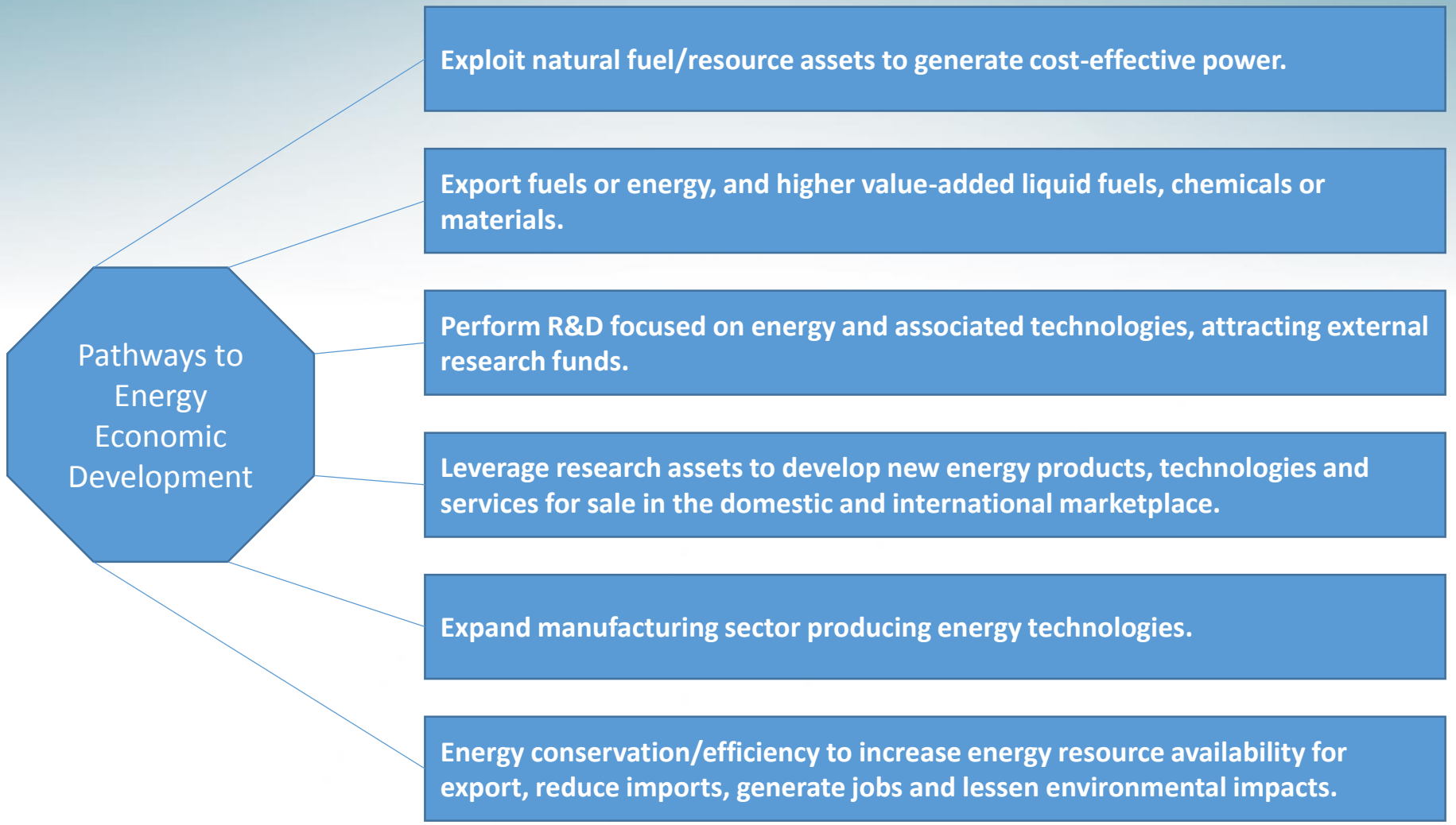
TECONOMY
PARTNERS LLC

Innovating Tommorow's Economic Landscape

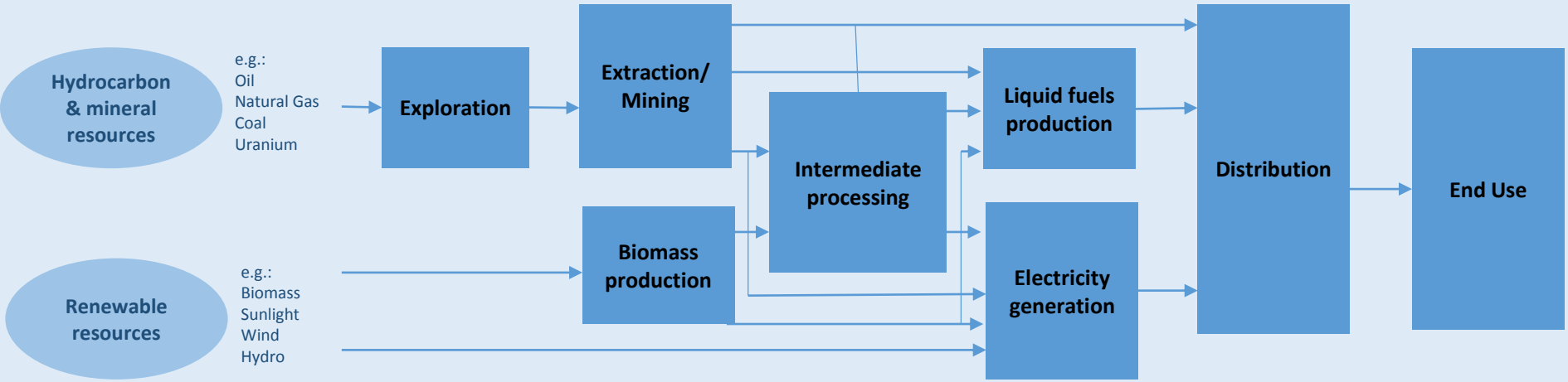
Iowa seeks to:

- Develop a detailed profile of energy in Iowa
- Identify trends likely to effect the impact of energy on the Iowa 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 energy-sector benefits for the Iowa economy

Multiple pathways for Iowa energy-based economic development.



Energy Production and Distribution Value Chain



Energy Tools, Technology and Services Development

- Exploration tools and technologies
- Mining, drilling and extraction technologies
- Ag/forestry inputs and production technologies
- Processing technologies
- Generation systems
- Pipelines, powerlines and distribution systems
- Grid/pipeline reliability, monitoring and associated systems
- Energy efficiency tech, propulsion systems, HVAC systems, power controls, etc.

Transportation systems and technology

Energy Business Location Factors

- Natural resources
- Policies, incentives and regulatory environment
- R&D capacity, capabilities and infrastructure
- Workforce, talent and skills
- Physical infrastructure
- Capital resources
- Business sites and facilities

TEConomy has produced five reports to inform the Iowa Energy Plan process.

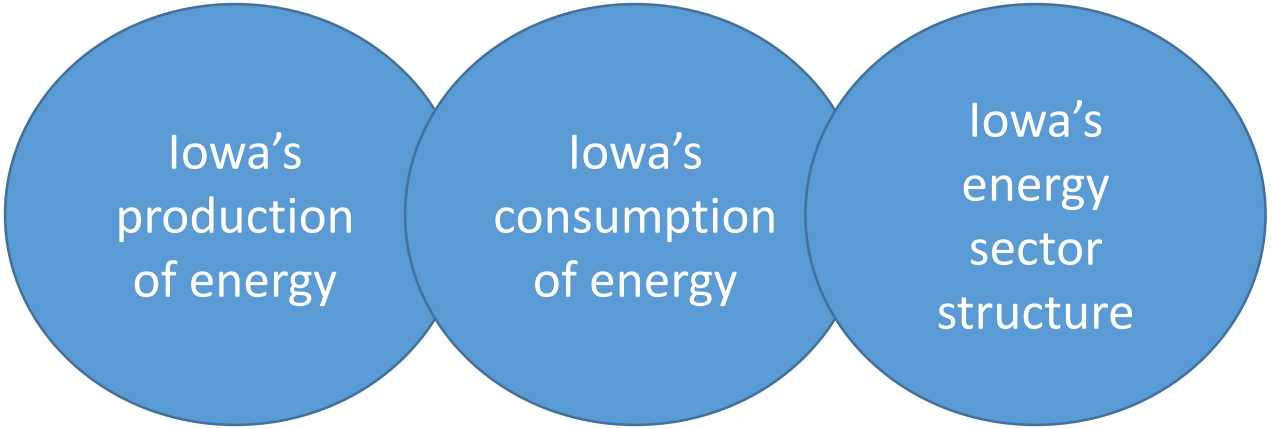
- Report 1. **Iowa's Energy Profile: Energy Supply and Demand and Sector Employment Analysis**
- Report 2. **Assessment of Iowa's Energy Position: Geographic Analysis**
- Report 3. **Iowa Energy Workforce Assessment**
- Report 4: **Input Received Through Stakeholder Input and SWOT Worksheets**
- Report 5. **Iowa Energy R&D Core Competencies and Opportunities for Energy-Based Economic Development**

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

TEConomy Partners Report 1

The Starting Point for the Project

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



Iowa's Energy Profile - Production

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

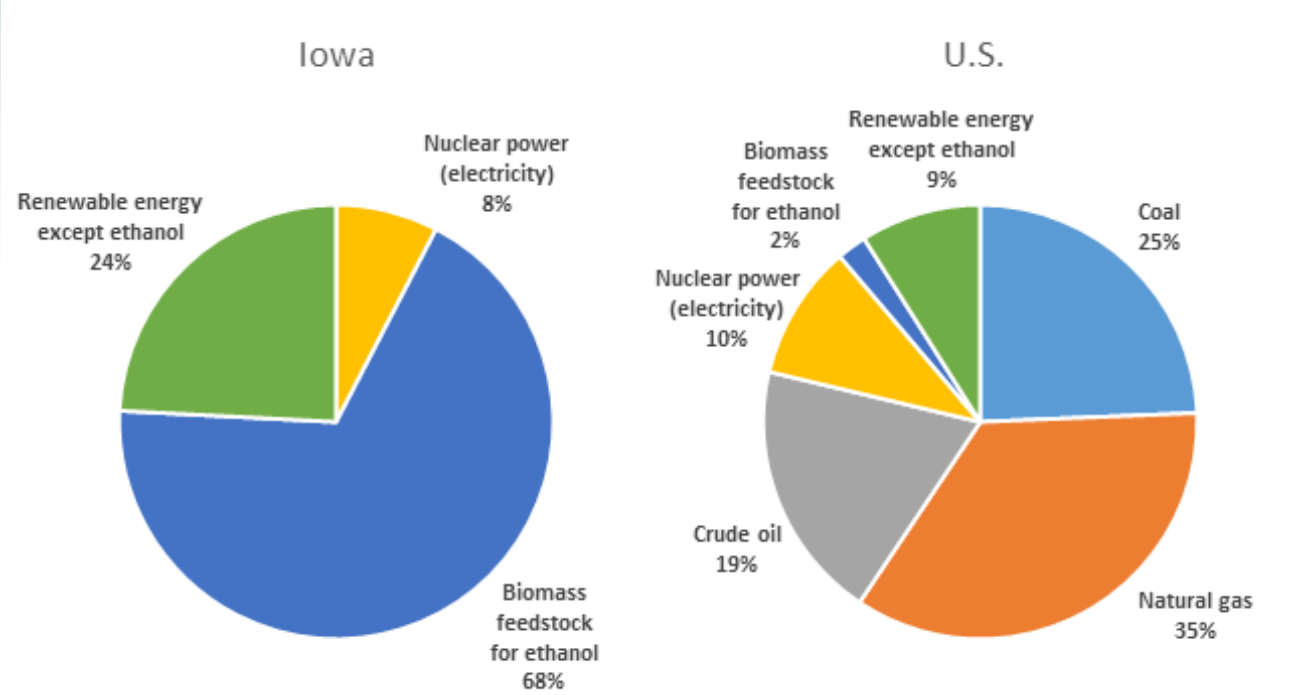
Conclusion 1: Iowa currently consumes more raw energy than it produces, and imports more raw energy than it produces.

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 lowering 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.

Production Share (Btu) by Major Source Category, 2013



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

Iowa's Energy Profile – Electricity Production

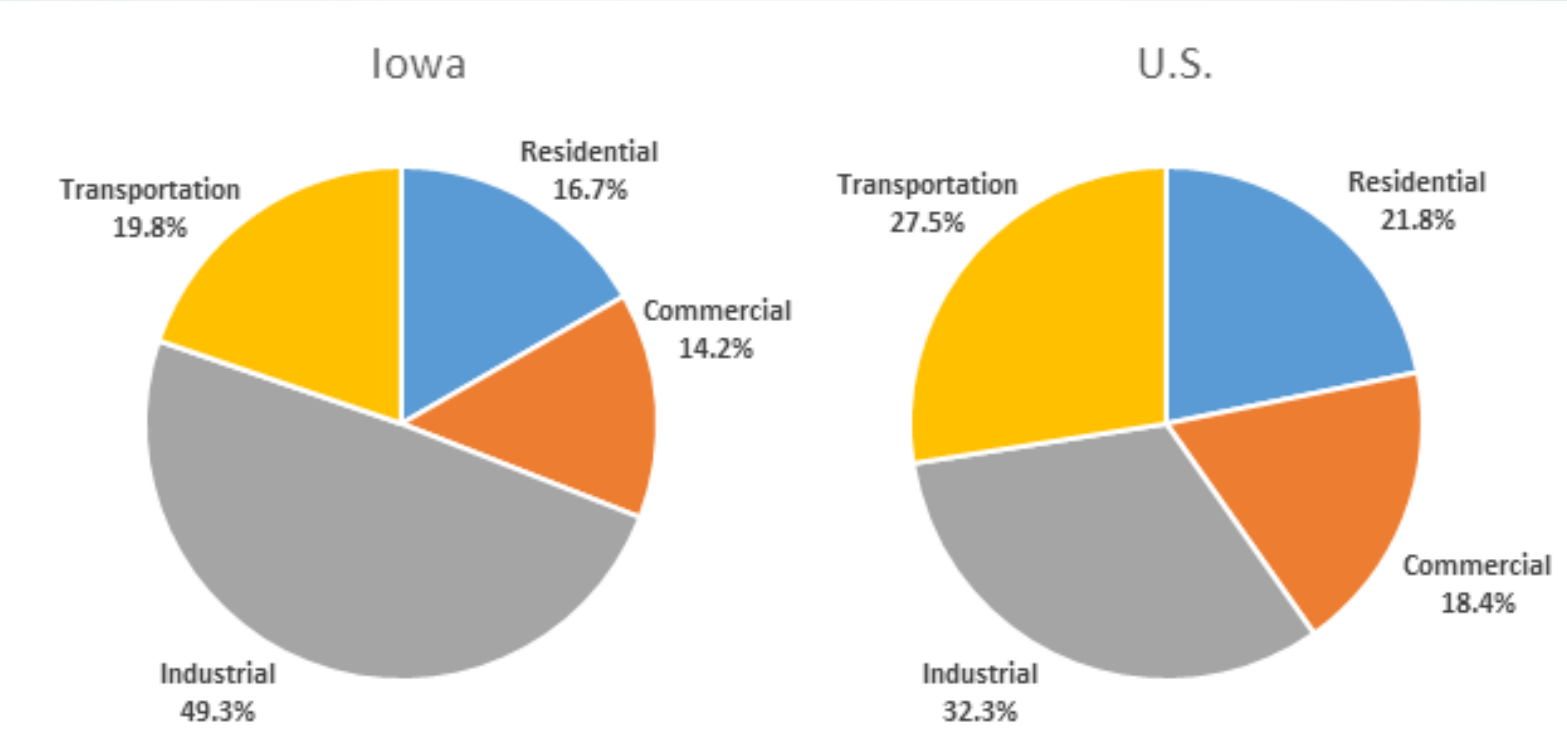
Total **electric** power generation in Iowa has increased significantly since 2001 growing from 40.7 million MWh in 2001 to 56.9 million MWh in 2014.

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 Utility)	0	21,000	--	0.04%
Other	8,000	0	--	0.00%

Conclusion 3: Since 2001 Iowa 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 Iowa's electricity generated by fossil fuels which declined from 87% in 2001 to 62% in 2014.

Iowa's Energy Profile - Consumption

Iowa's economy is **more industrially-intensive** 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

Iowa's Energy Profile - Consumption

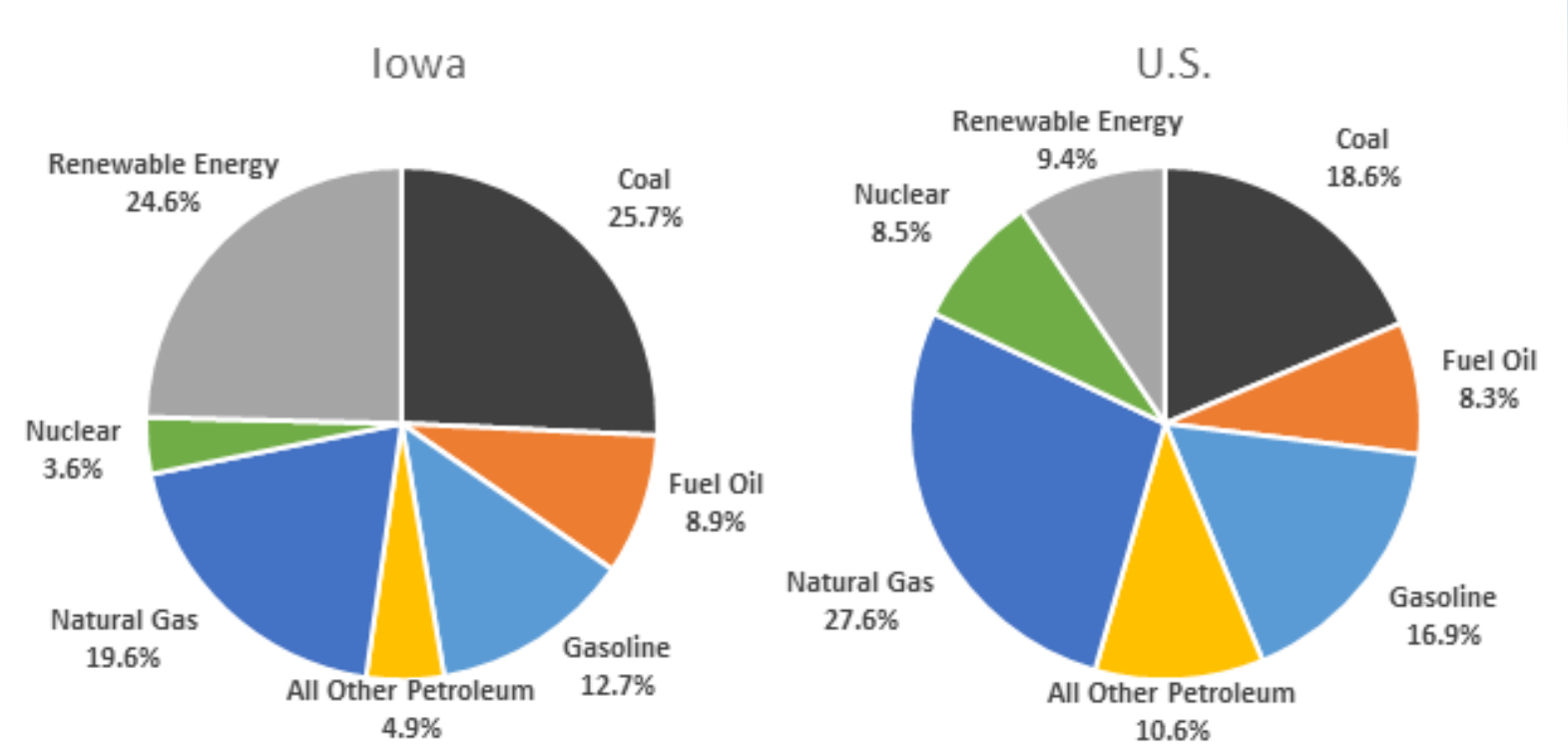
Energy Consumption Metrics by End Use Sector, 2013

	Iowa			U.S.	
Sector	2013 Consumption (Billion Btu)	Percent Change, 2000-2013	2013 Share of U.S.	2013 Consumption (Billion Btu)	Percent Change, 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%
Total Energy Consumption	1,516,483	27.2%	1.6%	97,144,709	-1.7%

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

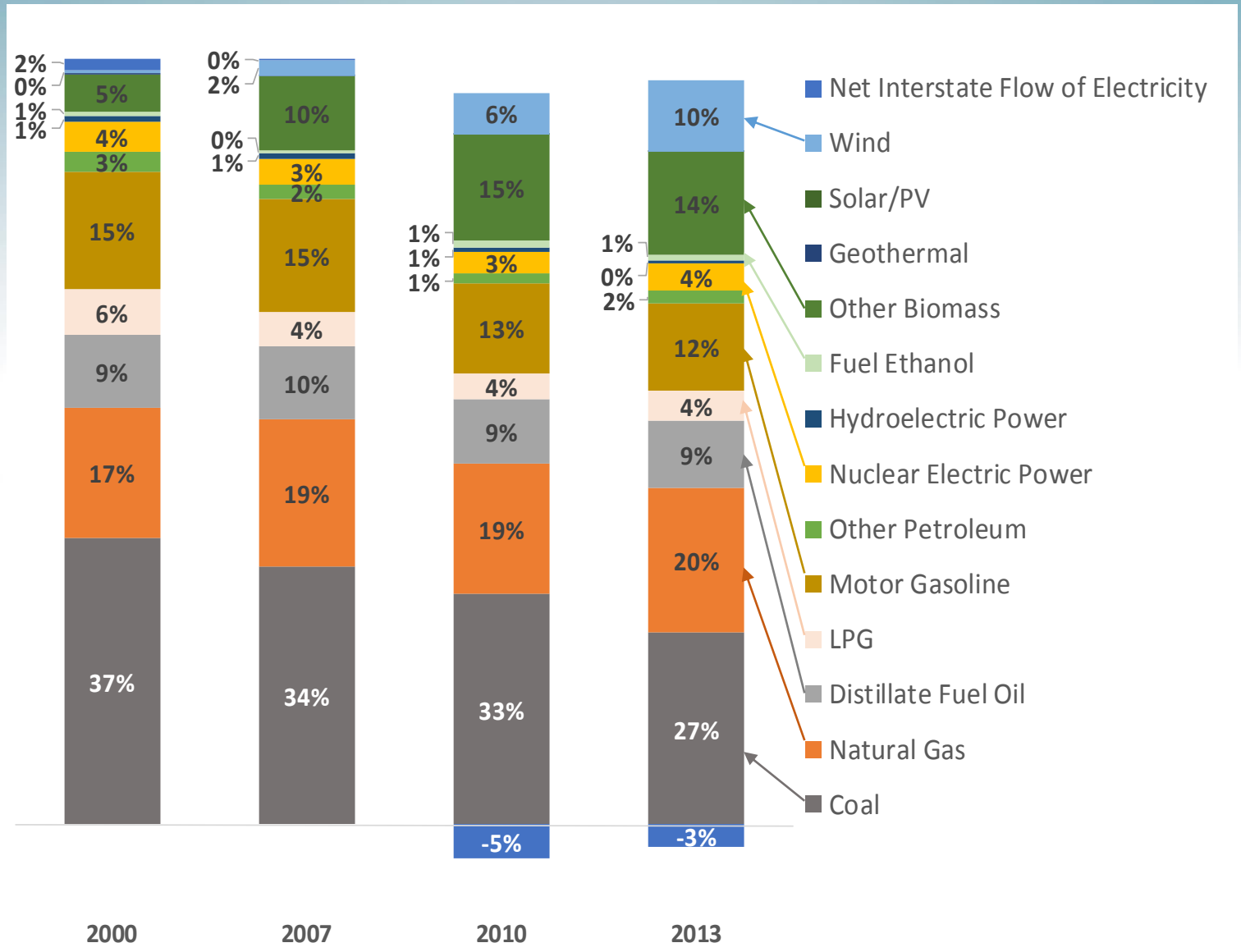
Iowa's Energy Profile - Consumption

Iowa uses renewable energy to a much **greater** degree 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

Iowa's changing energy consumption mix



Iowa's Energy Profile - Consumption

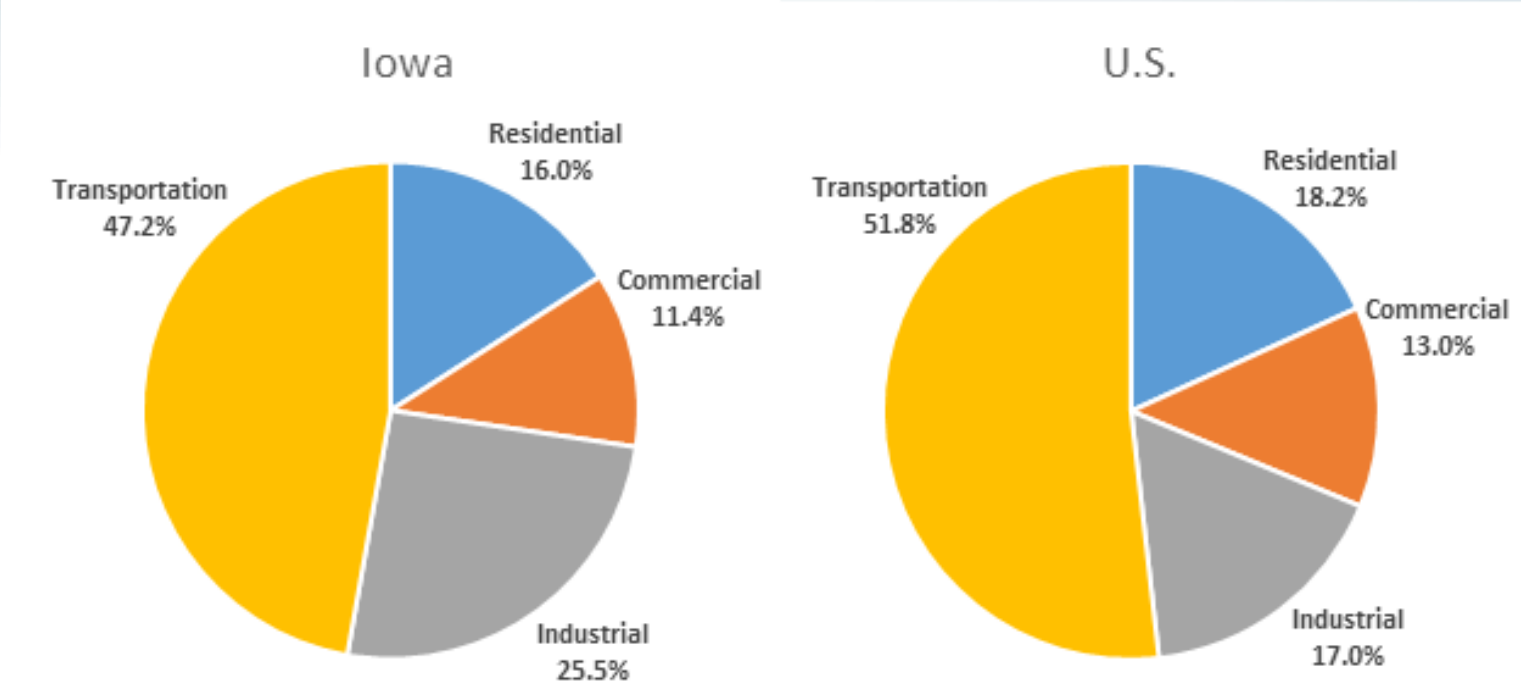
Energy Consumption Metrics by End Use Sector, 2013

	Iowa			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
Total Energy Consumption	**1,516.5**	**27.2%**	**1.6%**	**97,144.7**	**-1.7%**

Conclusion 5: 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

Iowa's **expenditure** profile in for energy is similar to the U.S. The main difference, again, is that Iowa 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

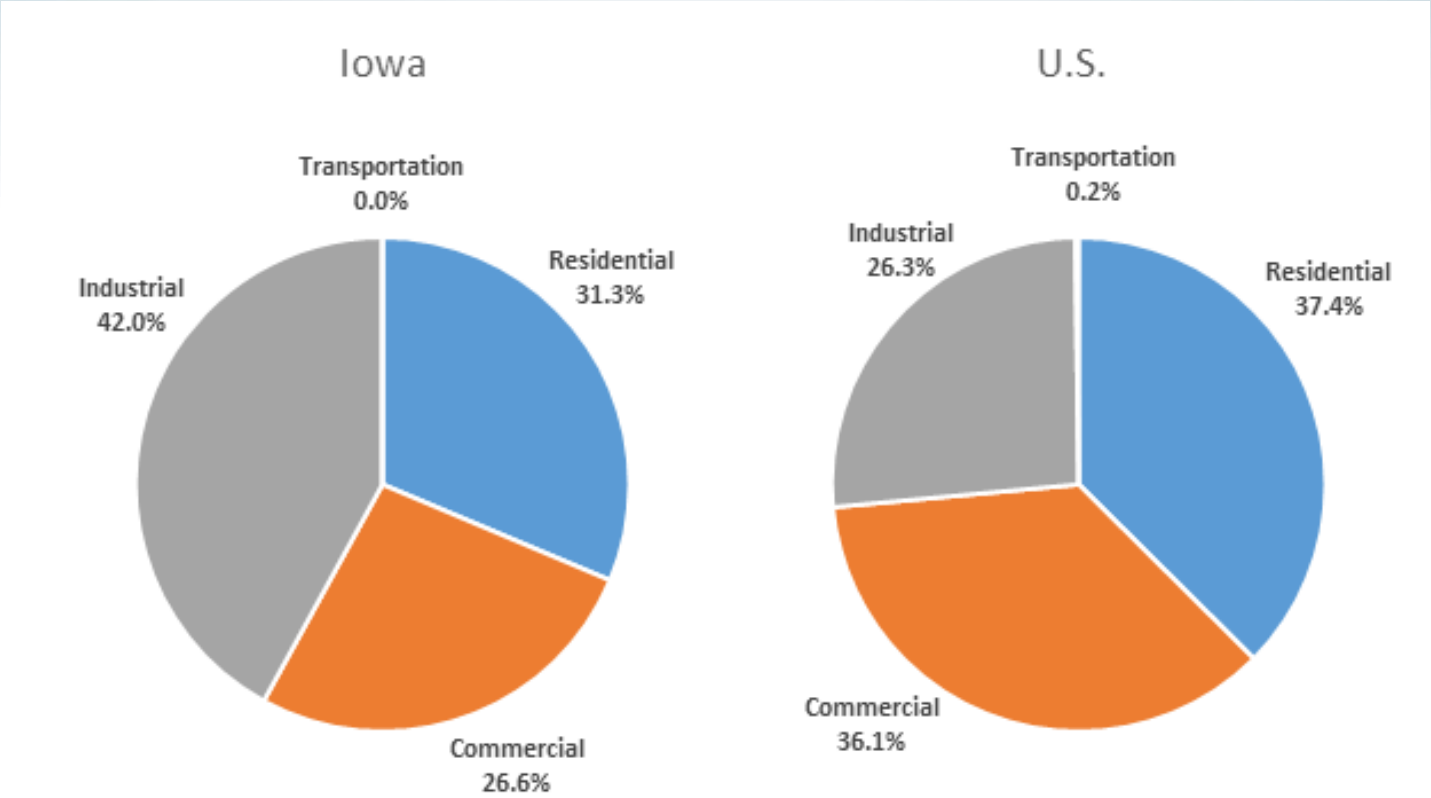
Energy Expenditure Metrics by End Use Sector, 2013

	Iowa			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%**
Motor gasoline	$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%**

Conclusion 6: 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, Iowa'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

	Iowa			U.S.	
Sector	2013 Consumption (Billion Btu)	Percent Change, 2000-2013	2013 Share of U.S.	2013 Consumption (Billion Btu)	Percent Change, 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%
Total Energy Consumption	**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 Consumption, 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
Iowa	**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
Iowa	**$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.

Conclusion 7: For Iowa, undertaking a state energy strategy is particularly important since energy consumption and expenditure per capita is higher than it is in surrounding states, 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

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 ENERGY PLAN

Iowa's Energy Profile - Employment

The Iowa 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	Iowa Estabs. 2014	Iowa 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%
Biodiesel Production	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

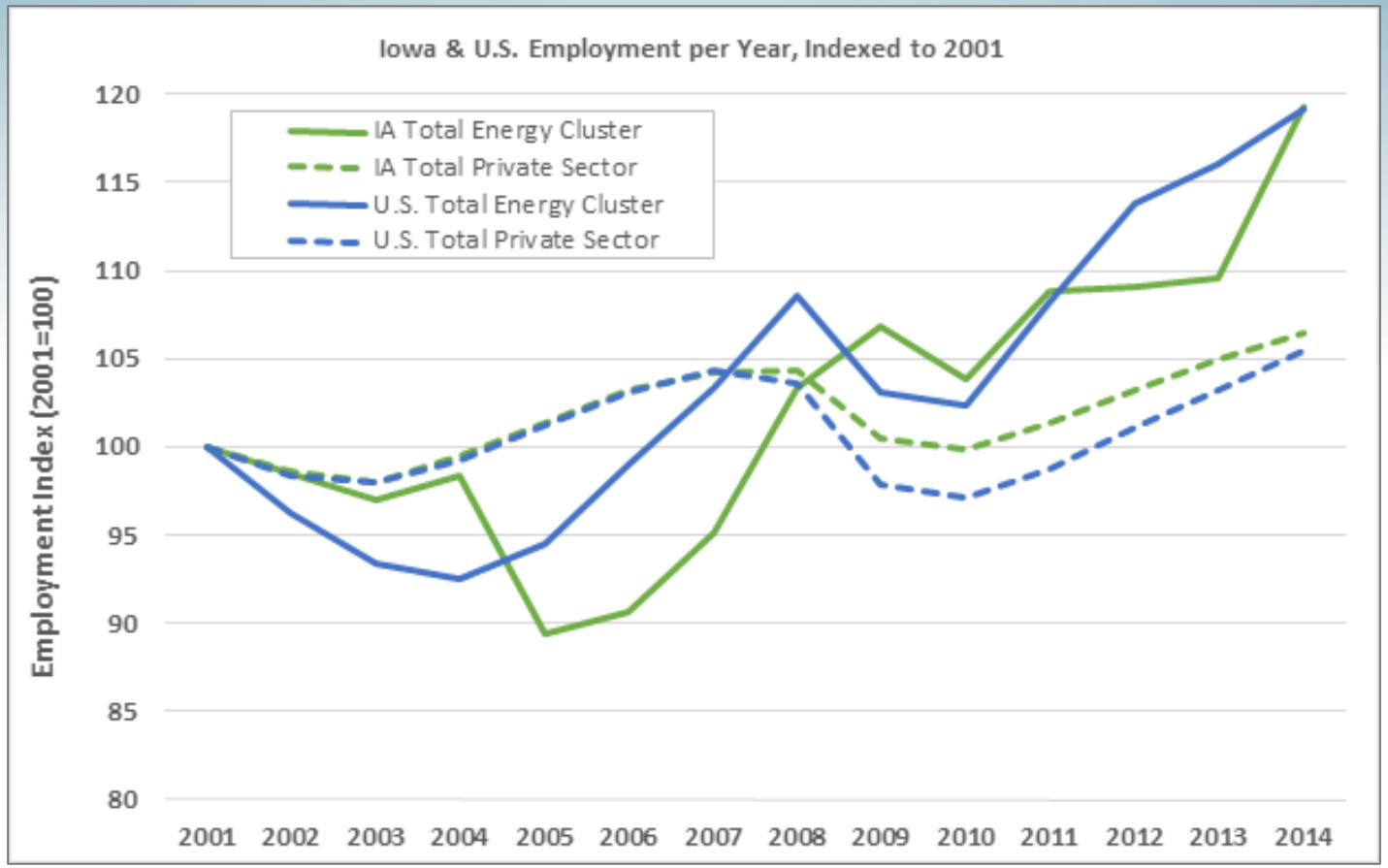
The **overall** Iowa energy cluster is currently under-concentrated in Iowa and therefore not seen as a state "specialization" (when aggregated).

Employment is highly concentrated 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."

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

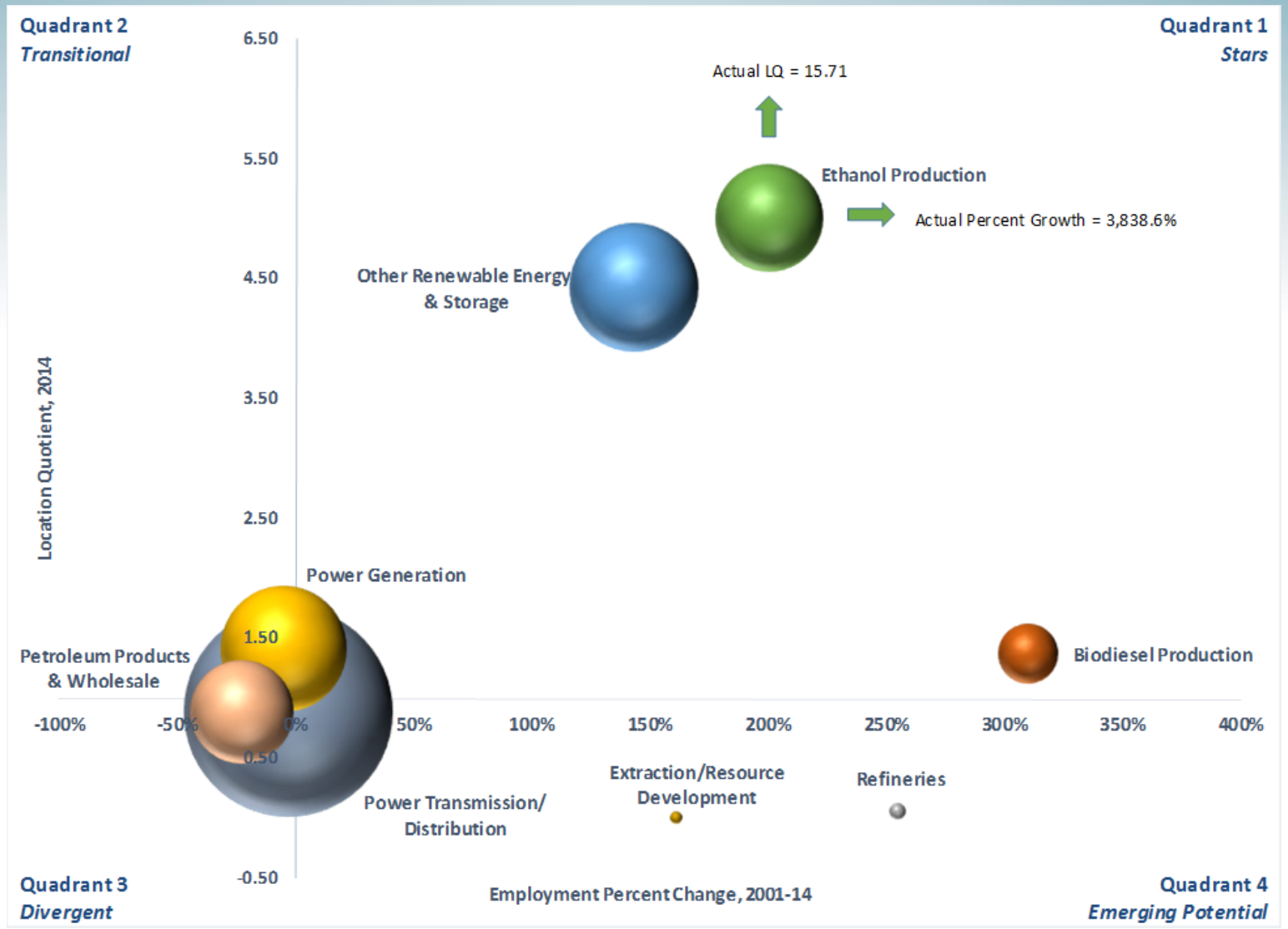
Iowa's Energy Profile - Employment

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



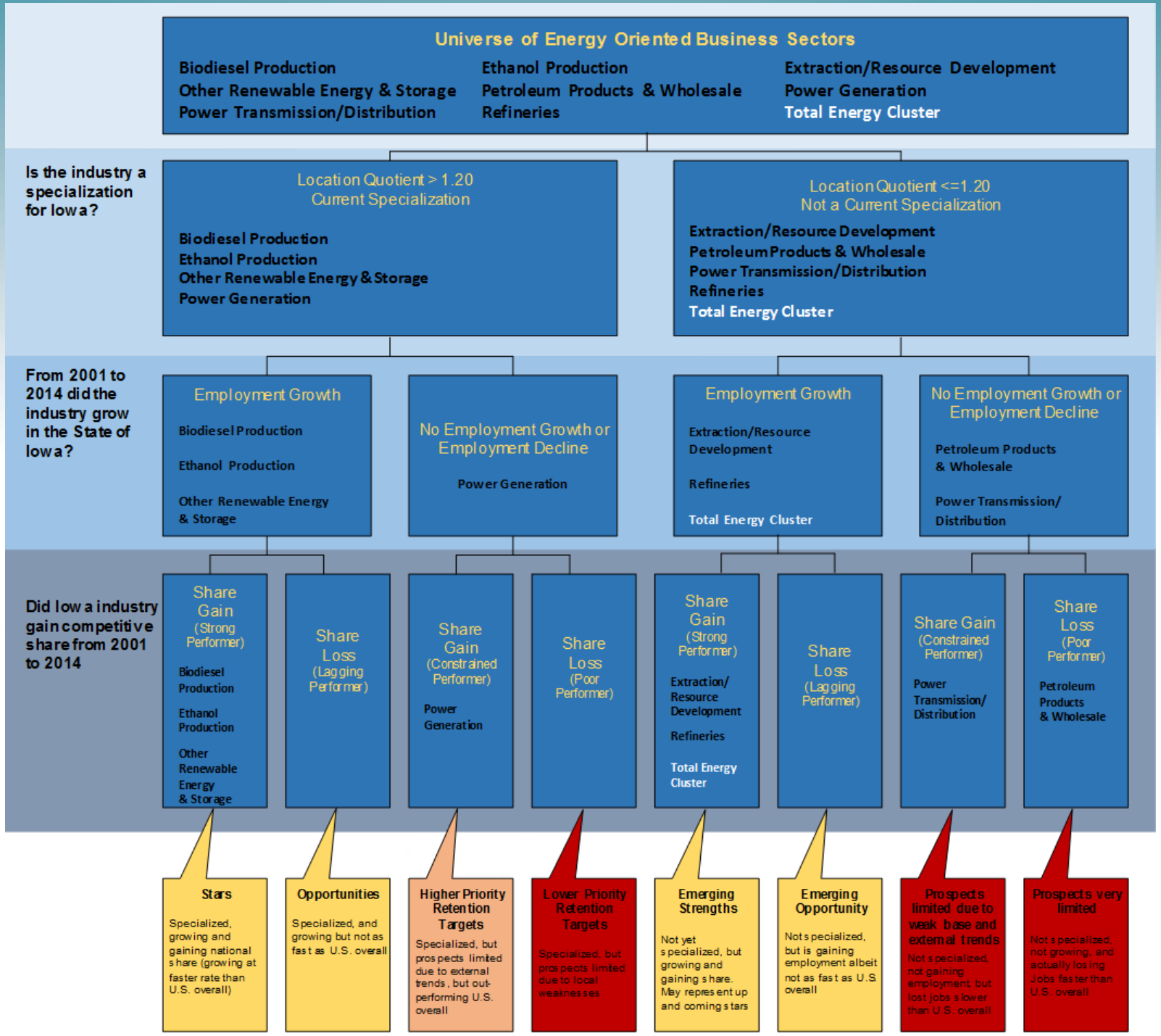
<u>Conclusion 9:</u> The Iowa Energy sector has seen significant net growth in employment since 2001, performing at the same level as the U.S. Energy sector and outperforming Iowa's overall private sector.

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

Energy Subcluster	NAICS Description	Establishments		Employment		LQ 2014
		Number, 2014	Growth, 2001-2014	Jobs, 2014	Growth, 2001-2014	
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 and Distribution	Electric Power Distribution (221122)	145	17.6%	**2,846**	**-19.2%**	**1.26**
	Power/Communication Line and Related Structures Construction (237130)	158	41.1%	**2,202**	**112.8%**	**1.20**


Universe of Energy Oriented Business Sectors
Biodiesel Production
Other Renewable Energy & Storage
Power Transmission/Distribution
Ethanol Production
Petroleum Products & Wholesale
Refineries
Extraction/Resource Development
Power Generation
Total Energy Cluster
Is the industry a specialization for Iowa?
Location Quotient > 1.20
Current Specialization
Biodiesel Production
Ethanol Production
Other Renewable Energy & Storage
Power Generation
Location Quotient <=1.20
Not a Current Specialization
Extraction/Resource Development
Petroleum Products & Wholesale
Power Transmission/Distribution
Refineries
Total Energy Cluster
From 2001 to 2014 did the industry grow in the State of Iowa?
Employment Growth
Biodiesel Production
Ethanol Production
Other Renewable Energy & Storage
No Employment Growth or Employment Decline
Power Generation
Employment Growth
Extraction/Resource Development
Refineries
Total Energy Cluster
No Employment Growth or Employment Decline
Petroleum Products & Wholesale
Power Transmission/ Distribution
Did Iowa industry gain competitive share from 2001 to 2014
Share Gain (Strong Performer)
Biodiesel Production
Ethanol Production
Other Renewable Energy & Storage
Share Loss (Lagging Performer)
Share Gain (Constrained Performer)
Power Generation
Share Loss (Poor Performer)
Share Gain (Strong Performer)
Extraction/ Resource Development
Refineries
Total Energy Cluster
Share Loss (Lagging Performer)
Share Gain (Constrained Performer)
Power Transmission/ Distribution
Share Loss (Poor Performer)
Petroleum Products & Wholesale
Stars
Specialized, growing and gaining national share (growing at faster rate than U.S. overall)
Opportunities
Specialized, and growing but not as fast as U.S. overall
Higher Priority Retention Targets
Specialized, but prospects limited due to external trends, but out-performing U.S. overall
Lower Priority Retention Targets
Specialized, but prospects limited due to local weaknesses
Emerging Strengths
Not yet specialized, but growing and gaining share. May represent up and coming stars
Emerging Opportunity
Not specialized, but is gaining employment albeit not as fast as U.S. overall
Prospects limited due to weak base and external trends
Not specialized, not gaining employment, but lost jobs slower than U.S. overall
Prospects very limited
Not specialized, not growing, and actually losing Jobs faster than U.S. overall

Iowa's Energy Profile - Wages

Industry Cluster, Subcluster, or Sector	Iowa 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%
Professional, Scientific, & Tech. Srvs.	$60,472	$86,391	70%
Refineries	$60,158	$132,020	46%
Manufacturing	$54,418	$62,977	86%
Construction	$51,934	$55,040	94%
Extraction/Resource Development	$51,191	$109,875	47%
Information	$50,764	$90,804	56%
Other Renewable Energy & Storage	$49,907	$73,100	68%
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%

Average Wages for Select Iowa and U.S. Industries, 2014

<u>Conclusion 11:</u> The energy cluster in Iowa 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.

Iowa's Energy Profile:
Geographic Analysis

TEConomy Partners Report 2

Geographic Analysis Content

I. Power Plants in Iowa by Capacity

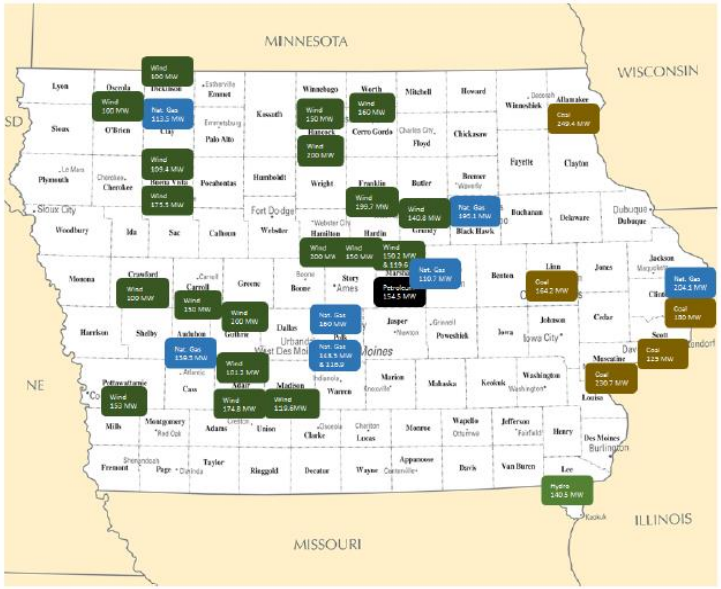
A. Introduction
B. Power Plants with Total Net Summer Capacity >500 MW
C. Power Plants with Total Net Summer Capacity 250-500 MW
D. Power Plants with Total Net Summer Capacity 100-249.9 MW

II. Power Plants by Primary Fuel

A. Coal
B. Wind
C. Natural Gas
D. Petroleum
E. Nuclear
F. Hydroelectric
G. Biomass

III. Other Geographic Information on Energy Infrastructure

A. Major Electricity Transmission Lines ≥ 345kV
B. Pipelines
C. Wind Resource
D. Solar (Photovoltaic) Resource
E. Solid Biomass Resource
F. Ethanol and Biodiesel Plants
G. Other Energy Infrastructure



IOWA ENERGY PLAN

Iowa Energy Workforce Assessment

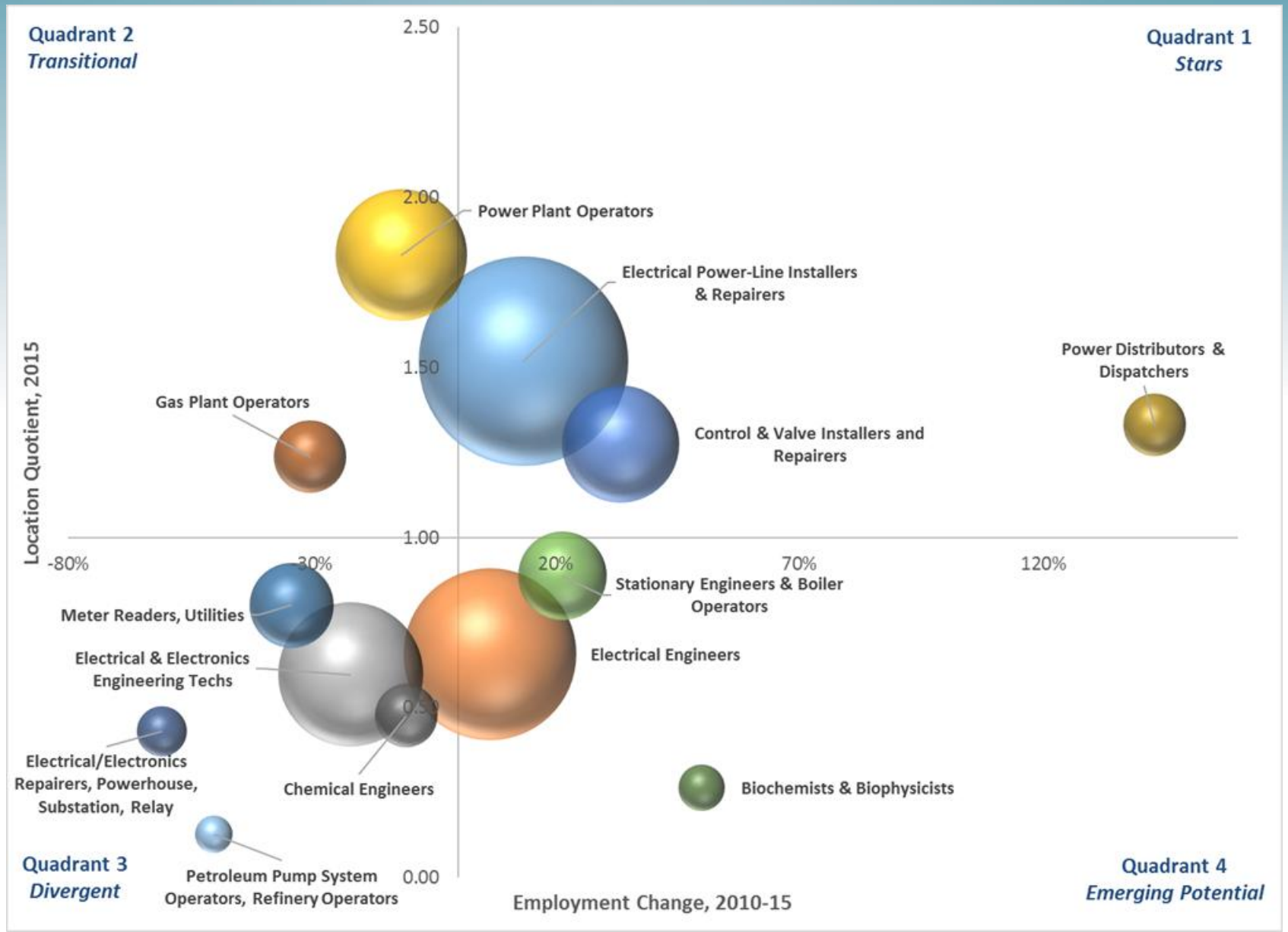
TEConomy Partners Report 3

IOWA ENERGY PLAN

Workforce report profiles…

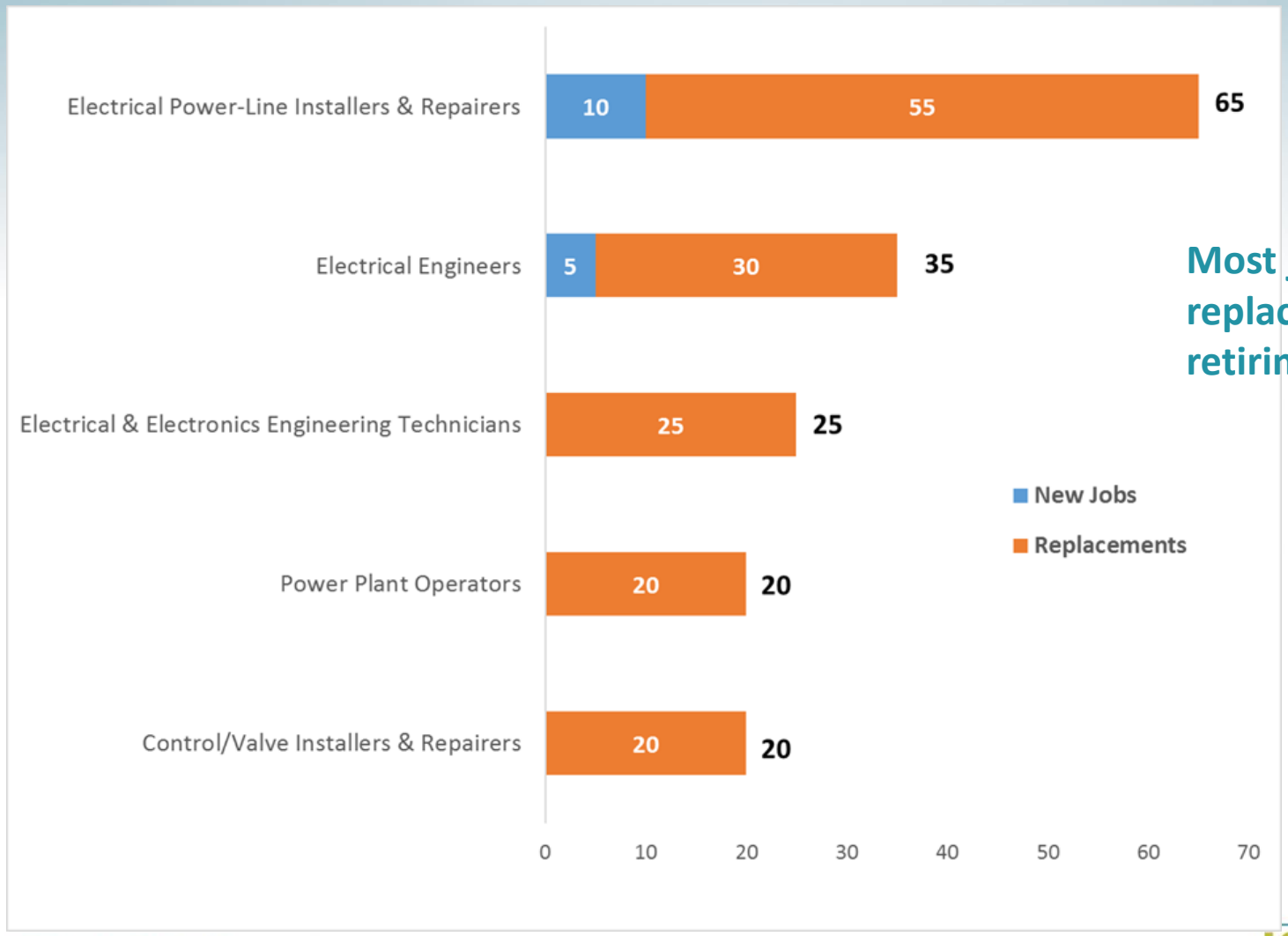
- Occupational demand trends
- Employment projections
- Education and training requirements

Occupation Summary



IOWA ENERGY PLAN

Projected Annual Job Openings in Iowa by Type of Opening, 2012-22 (Source: Iowa Workforce Development)



Most jobs will be for replacements for retiring workers.

Education and Training Requirements for Key Energy-related Occupations

Energy-related Occupations	Typical education needed for entry	Typical on-the-job training needed to attain competency in the occupation
Control and valve installers and repairers, except mechanical door	High school diploma or equivalent	Moderate-term on-the-job training
Electrical power-line installers and repairers	High school diploma or equivalent	Long-term on-the-job training
Gas compressor and gas pumping station operators	High school diploma or equivalent	Moderate-term on-the-job training
Gas plant operators	High school diploma or equivalent	Long-term on-the-job training
Meter readers, utilities	High school diploma or equivalent	Short-term on-the-job training
Petroleum pump system operators, refinery operators, and gaugers	High school diploma or equivalent	Long-term on-the-job training
Power distributors and dispatchers	High school diploma or equivalent	Long-term on-the-job training
Power plant operators	High school diploma or equivalent	Long-term on-the-job training
Stationary engineers and boiler operators	High school diploma or equivalent	Long-term on-the-job training
Electrical and electronics repairers, powerhouse, substation, and relay	Postsecondary nondegree award	Long-term on-the-job training
Wind turbine service technicians	Some college, no degree	Long-term on-the-job training
Electrical and electronics engineering technicians	Associate's degree	None
Chemical engineers	Bachelor's degree	None
Electrical engineers	Bachelor's degree	None
Biochemists and biophysicists	Doctoral or professional degree	None

Input Received Through Stakeholder Input and SWOT Worksheets

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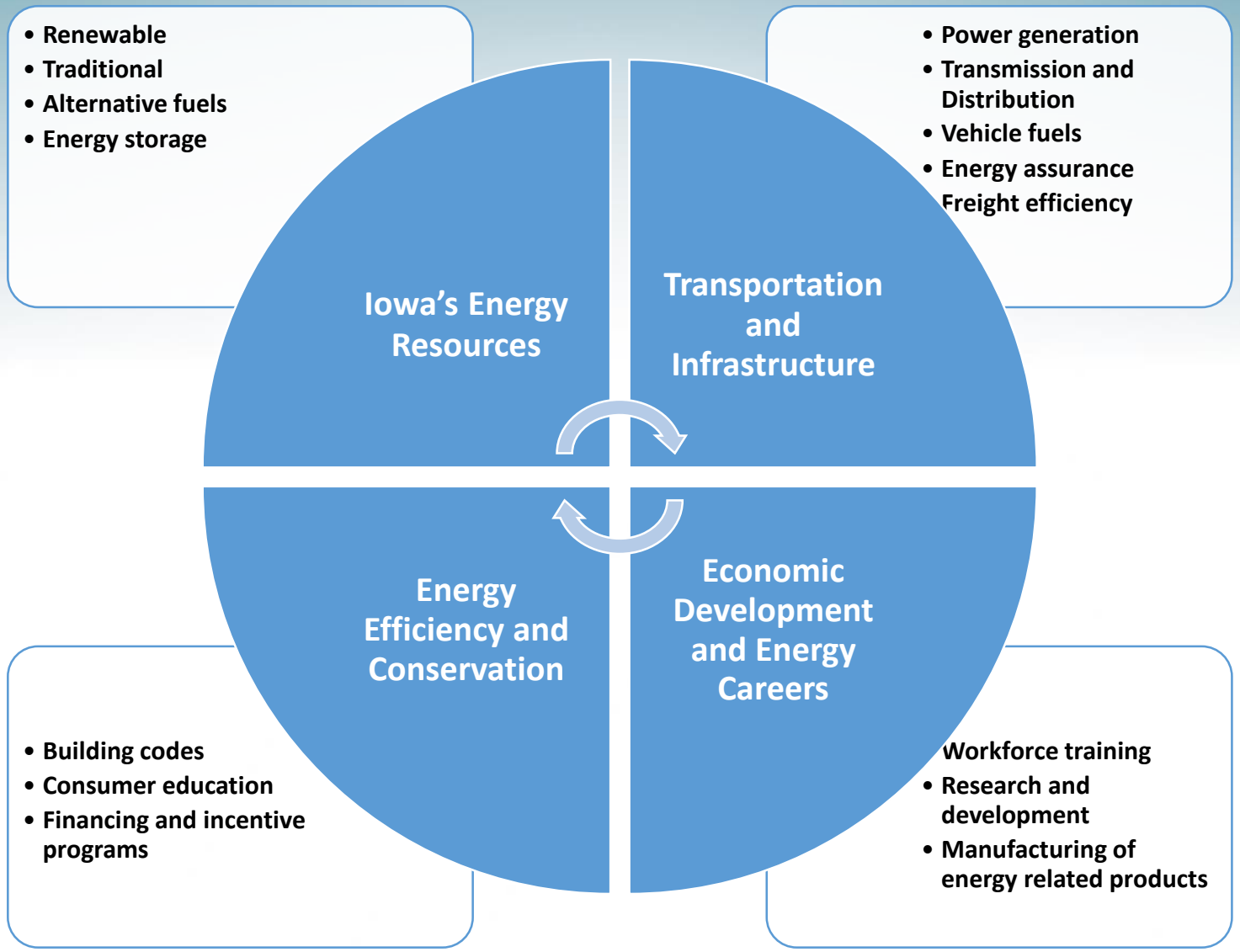
SWOT reporting uses the Working Group structure



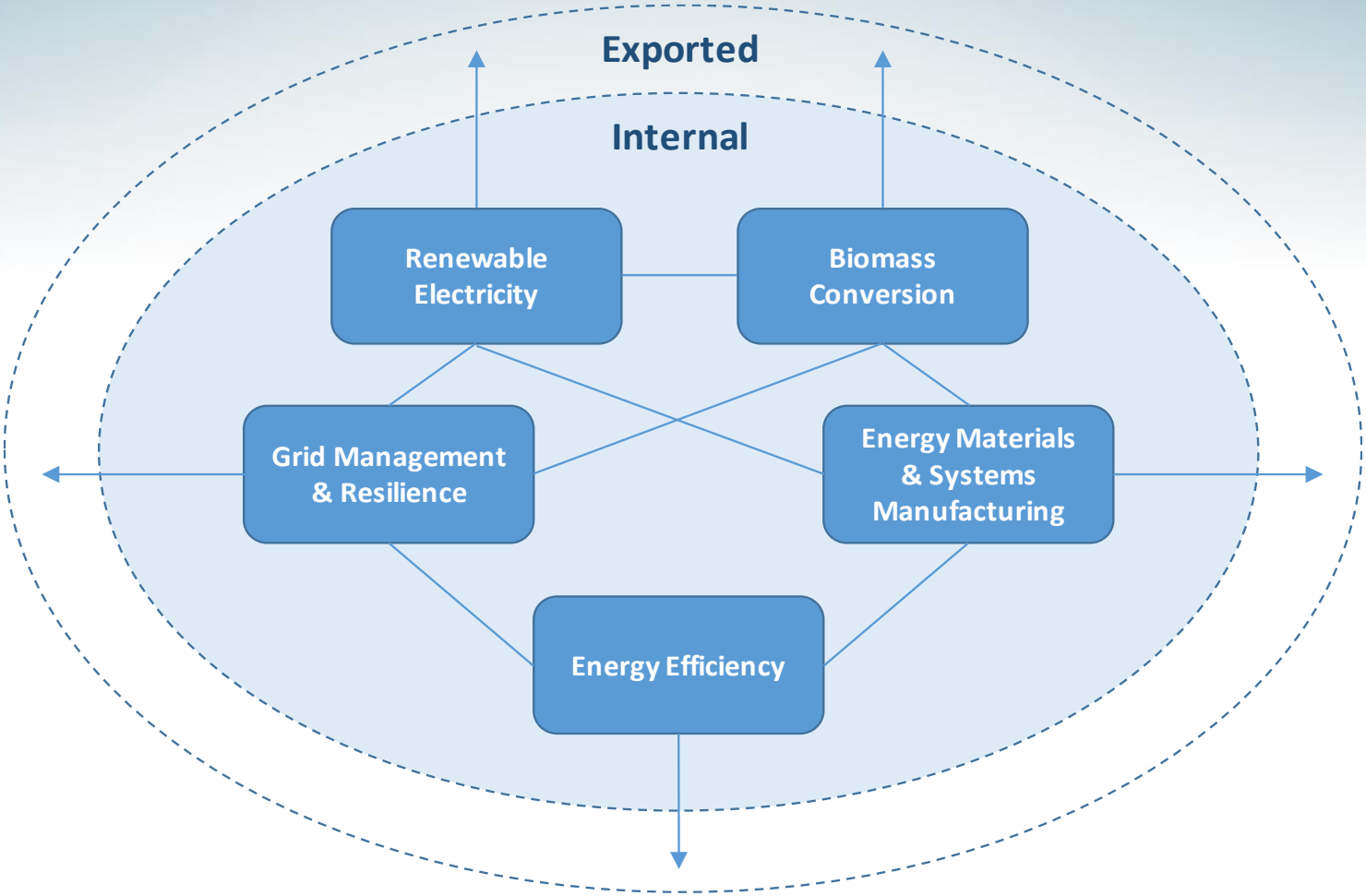
Iowa Energy R&D Core Competencies and Opportunities for Energy-Based Economic Development

TEConomy Partners Report 5

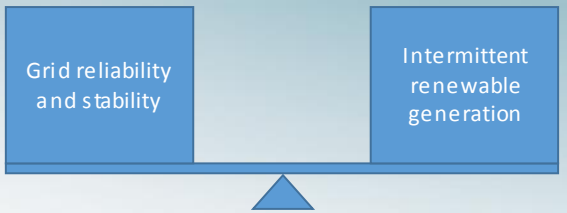
Five Recommended Platforms

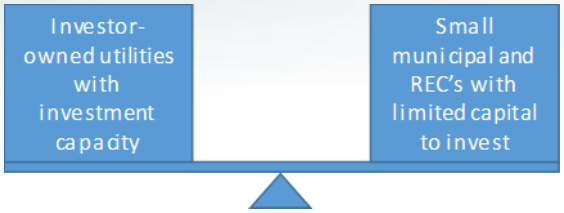
- **Renewable Electricity Platform:** Focused on the ongoing growth of wind power, and increased attention to be paid to solar PV installations, to generate substantial excess power capacity for export outside of the State of Iowa. The platform also includes development of enhanced transmission line capacity to connect Iowa assets to out-of-state markets
- **Biomass Conversion Platform:** Focused on the conversion of Iowa's abundant supply of biomass (especially cellulosic biomass) into liquid fuels and high value-added chemicals.
- **Grid Management & Resilience Platform:** Focused on leveraging the diverse characteristics of the Iowa energy grid in terms of utility types and sizes, renewable generation integration, distributed generation, etc. for the development and testing of grid management technologies and smart grid systems.
- **Energy Efficiency Platform:** Advancing best practices in proven energy efficiency strategies and technologies, in combination with the development of new energy efficiency innovations.
- **Energy Materials and Systems Manufacturing Platform:** Building upon Iowa's R&D core competencies in materials and the design and production of energy technologies to advance new manufacturing ventures and help existing companies expand and improve their product lines.

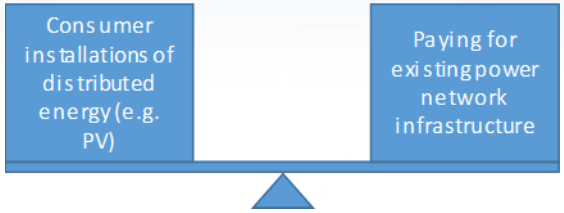
Five Energy-based Economic Development Platforms Identified

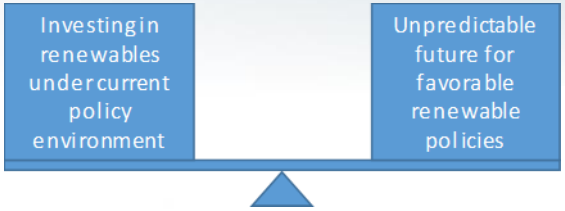


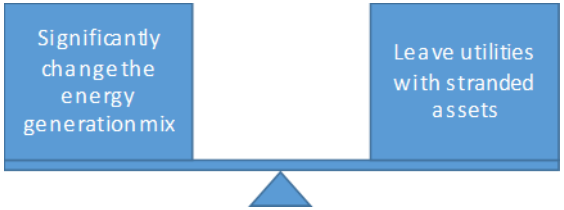
Balancing “tensions”

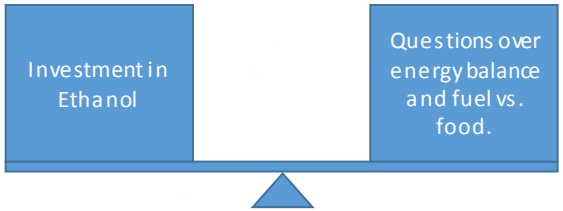


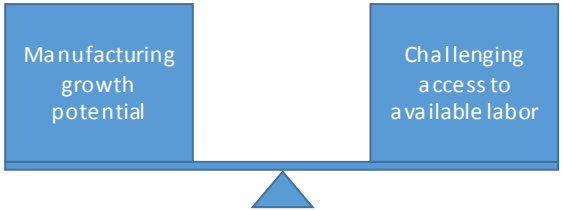












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Innovating Tommorow's Economic Landscape