



Infrastructure
STRATEGY
For Iowa's Future Economy

Energy Sector
REPORT & RECOMMENDATIONS

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Energy Sector Committee Members

Roya Stanley, Sector Committee Chair, Iowa Office of Energy Independence, Des Moines

Thom Hart, Iowa Department of Economic Development, Des Moines

Andrew Anderson, Faegre & Benson Law Firm, Des Moines

Mick Barry, Greenstar North America, Des Moines

Rob Berntsen, Iowa Utilities Board, Des Moines

Dr. P. Barry Butler, The University of Iowa College of Engineering, Iowa City

Dean Crist, MidAmerican Energy, Des Moines

Regi Goodale, Iowa Association of Electric Cooperatives, Des Moines

Supervisor Jane Halliburton, Story County Board of Supervisors, Nevada

Peter Hemken, Dupont Company, Johnston

Dr. Patricia Keir, Eastern Iowa Community College, Davenport

Dr. Alexander King, U.S. Department of Energy, Ames

Bob Loyd, Clipper WindPower, Cedar Rapids

Dr. Alan Meyer, East Marshall Schools, Gilman

Stephen Newell, IBM, Springfield, Illinois

Lucy Norton, Iowa Renewable Fuels Association, Johnston

George VanDamme, Deere and Company, Moline, Illinois

Les Wilson, The Energy Group, Des Moines

Introduction

Iowans have high expectations for a strong economy, good jobs, and a future of opportunity. Setbacks came in 2008 with the summer disasters, followed by the national recession and significant impacts on Iowa's infrastructure. Even while addressing those challenges through the influx of federal and state short-term funding for jobs, infrastructure, disaster recovery, and other broad needs, Iowans must also consider the vision for the future economy and the infrastructure it will demand. Interested Iowans statewide will find in this report a set of recommendations and a strategic direction for the energy sector.

Energy was the subject of deliberations over a four-month period by a diverse array of Iowans who contributed their expertise, experience, and perspectives on the future economy and the energy infrastructure that will be required to meet future needs. Because stakeholders from across the state developed the report, it reflects and has future application to diverse stakeholders, including the private sector, issue-based groups, nonprofit organizations, academia, and local and state government.

As attention at both the national and state levels has turned to the promise of new energy policies and associated smart planning and growth principles, the energy sector in Iowa has risen to new heights. Smart planning decisions need to consider the growing needs of the state's business and industry, as well as the protection of farmland and the Iowa economy. Iowans have recognized that in order to remain competitive on the national and international levels, an energy industry must continue to be developed that utilizes the state's unique and rich natural resources. Additionally, Iowa's energy use is increasing, highlighting the issue that more efficient generation, transport, and use will be necessary to sustain a high quality of life for Iowans and expand opportunities for economic recovery and vitality.

The Energy Sector Committee worked to create a list of priority issues and corresponding recommendations that genuinely support Iowans and future generations. Energy is an important part of an Iowa solution to create a robust economy and maintain the state's economic vibrancy through effective, efficient, and strategic use of the state's unique resources. These resources can lead to the development of new technologies that have potential for state, national, and international application. This report does not stand alone, however. As part of a comprehensive and coordinated statewide planning initiative, the recommendations and insights on the energy sector will be considered by a Task Force, along with similar reports on infrastructure needs for the future economy in buildings and vertical infrastructure, natural resources, telecommunications, and transportation. The ideas and recommendations contained in the five reports and the coordinated plan from the Task Force reflect the involvement and engagement of more than 200 Iowans over a span of nine months. From those deliberations, a strategy for Iowa's future economy was developed on behalf of and for all stakeholders. It is the hope of the Energy Sector Committee that policymakers, community leaders, business and industry, and others find ways to implement or support the recommendations of this sector report and those of the coordinated Infrastructure Strategy for Iowa's Future Economy.

Executive Summary

Iowa's investment in energy through transportation, electricity, natural gas, propane, and other energy sources, has created jobs, new businesses, and other benefits for the environment and agricultural sector of the state's economy. To continue trends and expand, the Energy Sector Committee recognized the importance of comprehensive planning to spur innovation in the full energy life cycle. Infrastructure needs were noted to be different depending upon regulation, practice, management structures, and scientific innovation; however, several priorities were shared between energy segments. The Sector Committee identified an important crossroads between the infrastructure needs for expansion of wind, solar, and biofuels technology. These priorities included planning for and mitigating disaster, reducing the state's energy consumption, and increasing production to utilize Iowa's unique renewable resources including wind, soil, and water. The Committee also recognized the need to spur growth and investment in Iowa energy sources to support the state's economic opportunities and make a commitment to long-term climate change solutions.

There will be an economic advantage to developing the ability to adapt to a new energy future if the state can produce and utilize a variety of fuels and capitalize on the opportunity to deliver to other states. Additionally, Iowa must focus on knowing what other states are producing and utilizing in order to make the greatest impact. The committee agreed that the state of Iowa enjoys strengths in its current energy infrastructure that include technology and innovation at the academic and business levels, a commitment to natural resources, a strong agricultural economy, and well-maintained roads. The group also identified current weaknesses, including dependence on imported energy and stressed a continued need for robust transmission and transport systems. Additionally, they recognized that the system must be coordinated in order to respond quickly to changes in technology and that Iowa must build a system of public understanding and demand for clean, low or no carbon Iowa-based energy solutions.

The Energy Sector Committee defined their scope as the "components of the production, transmission, transport, distribution, storage, and usage systems that provide for efficiency, opportunities to increase affordability, safety, environmental and human health, reliability, and availability for the state to become energy independent and position Iowa as a supplier of energy and energy technologies to support economic development."

The issues identified by the Energy Sector Committee included the following:

- Energy production and usage patterns are continually evolving, and while certain aspects of the energy future remain unclear, some trends are already known.
- There is a need for infrastructure enhancements and a readily available, trained, and educated workforce to support the energy future.
- Iowa has a substantial existing infrastructure that needs to be considered.
- A diverse and flexible energy infrastructure is needed to support harvest, storage, transportation, conversion, access to sustainable raw materials and natural resources, and distribution.
- Leveraging rail, wires, pipelines, and rivers is critical to maximize the transmission and transport of energy.
- Customer behavior has a large impact on energy use and efficiency.

The Energy Sector Committee made five recommendations to address the priority issue areas:

- There should be a system to support an energy literate population in Iowa through education and information on implementing solutions to meet energy goals.
- There should be a business climate and stable government investment structure that responsibly supports energy technology research, development, demonstration, and deployment. This structure would include policy and financial incentives to support all phases of development from early stage commercialization to the marketplace.
 - Policy and financial incentives in these areas should reflect both environmental and cultural factors.
 - This will require easy access, influence, and capitalization of federal opportunities and policies that benefit the state and nation.
 - Iowa should be a leader in the global economy through lower energy costs and innovation.
- There should be recognition that Iowa's primary resources (soil, water, wind, and an educated, motivated workforce) provide value-added opportunities throughout the state, and that capitalization requires consideration for the state's diverse communities and sustainability.
- There should be recognition that infrastructure policy decisions must balance need for stability, flexibility, and agility, while appropriately valuing current infrastructure.
- There should be coordinated outreach in energy efficiency across sectors, establishing Iowa as a leader in best practices.

Although the energy future is evolving, it is clear that Iowa will need an environment that offers a variety of energy options, adaptability to changing innovations, and, ultimately, priority areas on which to concentrate resources and planning. Cooperation and collaboration is necessary through public-private partnerships, both to establish a shared vision and to ensure adequate investment. In Iowa, lower energy costs and innovation have a positive impact on the economy. Having a climate that supports energy research, development, demonstration, and deployment from early stage commercialization to the marketplace brings business to Iowa and cultivates ideas within existing businesses. Iowa can continue to lead in energy by creating a system that promotes and values the energy industry, recognizes existing natural resources and developments, and builds a culture of energy responsibility and education. Iowa's existing infrastructure plays an important role in ushering in success of these new possibilities. Some structures and systems may need to be re-thought or updated, but through prioritization, the state can move forward in a way that can help ensure smart planning and growth.

Iowa's Future Economy

There is no crystal ball to predict exactly what Iowa's economy will be like in 2020 and beyond, but there are indicators and steps that can be taken to shape the economy as Iowa recovers from the dual challenges of the 2008 disasters and the national recession. The Infrastructure Strategy for Iowa's Future Economy initiative was designed to work from a common understanding of Iowa's current economy and forecast of economic factors in order to establish strategic direction for the state. Essential elements of the future economy were identified from this information and from the deliberations of the participants in the process. This section highlights the foundational premises of the Sector Committees and Sector Chairs Group that guided their work.

Essential Elements of the Future Economy

Iowa's economy has faced challenges due to the disasters and the recession; conversely, Iowa's economy can benefit from the opportunities presented as the state recovers from these challenges. This will require a commitment to innovative and strategic thinking now, which tend to be a departure from day-to-day challenges to infrastructure. In early discussions, each Sector Committee and the Sector Chairs Group worked to identify how Iowa's economy can build upon current short term investments to grow stronger and enhance global competitiveness.

Eight essential elements of the future economy were identified by the Sector Committees and the Sector Chairs Group. The essential elements were used by the Sector Committees to guide and measure their work and their recommendations against the vision for Iowa's economic future.

The Essential Elements of Iowa's Future Economy are:

- Smart growth
- A diversified economy that ensures a strong agricultural sector
- A skilled workforce for quality jobs
- Environmental stewardship
- Iowa-based energy solutions
- An economy that is globally competitive
- A population that chooses to live and work in Iowa
- Realistic funding for new and maintenance of infrastructure

Iowa's Current Economy and its Impacts

In the current environment in Iowa, a number of trends are affecting the state's economy. The following factors are taken from data provided to the Sector Committees by researchers at Iowa State University's Department of Economics. First, the population of Iowa is shifting from rural to urban areas. Two other factors include the aging population and the baby boomer generation nearing retirement age. There has been an increase in the outmigration of youth workers to other states, and most population growth in Iowa has been due to increases in immigrant and minority residents in the state.

Because of the economic recession and the scaling back or closing of significant numbers of manufacturers across the state, non-metropolitan Iowa is losing both jobs and population between ages of 25 and 44. This has an echo effect of population loss in the under-20 category, reflecting children of 25-44 year-olds. Iowa's unemployment rate, which has typically remained relatively low, may start to have a structural upward shift. The rural housing stock is

deteriorating, and economic vitality is concentrated in relatively few areas. Additionally, tax capacity in non-metropolitan communities is rapidly eroding due to population shifts and loss of manufacturing employers. However, rural energy opportunities, such as biofuels and wind, are evolving.

Iowa in 10 Years

ISU researchers predict that in ten years, Iowa will see the results of current trends in population, namely, that there will be fewer people in non-metropolitan areas, more investment and growth in metropolitan areas, and continued outmigration of young and working-age people. Regional trade centers, called micropolitan communities (populations of 10,000 – 50,000 people), will be mostly stable, but not growing. The sectors that will lead in job demand will be business, personal care, education, and health services. Although some downplay the role of energy production in rural resettlement, the Sector Committees identify the energy industry's crucial role in the future economy of Iowa as a significant contributor to the overall rural economy and its potential to mitigate factor in further rural depopulation. It is also predicted that manufacturing will still be important, but the number of jobs will have decreased. The manufacturing businesses that remain will be those with the most efficient and productive processes.

The Issues

The Energy Sector Committee defined their sector as “components of the production, transmission, transport, distribution, storage, and usage systems that provide for efficiency, opportunities to increase affordability, safety, environmental and human health, reliability, and availability for the state to become energy independent and position Iowa as a supplier of energy and energy technologies to support economic development.” The Sector Committee members especially noted that success and innovation can only be seen in an environment that supports and invests in new ideas and technologies for systems that produce, transport, and use energy. The Committee also recognized the incredible pace of the energy industry and the need to be responsive to innovations, policy, and practices in Iowa and around the world.

To secure a successful energy future in 2020 and beyond for Iowa, the following issues were identified as priorities to be addressed..

Energy production and usage patterns are continually evolving, and while certain aspects of the energy future remain unclear, some trends are already known.

The Energy Sector Committee concluded early in the process that cost and the way energy is produced, distributed, or used will not be the same in 2020. Science is moving faster than ever before, and each breakthrough will require adapted infrastructure. The Sector Committee agreed that as new technology is developed, there is little to no existing infrastructure to switch from one type of energy source to another. This lack of connectivity is also important when considering the current intermittency of renewable fuels, such as wind, solar and biomass, that are dependent upon non-controllable environmental factors for production. As referenced in the Office of Energy Independence Comprehensive Plan and attributed to the Iowa Climate Change Advisory Council report, biomass is defined as “biological material that can be used as a fuel or for industrial production.” Adequate backup and storage systems must be a part of the infrastructure discussion to ensure a robust menu of energy production options for Iowa.

Scientists predict that the energy future will be a mixed use of oil, natural gas, solar, wind, nuclear, coal, hydroelectric, and other energy sources. Energy production has been cited as slightly easier to predict than usage and will include coal, due to its low monetary cost, and natural gas, due to its supply and reliability. Wind opportunities are predicted to grow, and the biofuels industry is also expected to have a strong future as the scientific community innovates to replace the petroleum molecule with bio-materials for a range of products beyond energy, such as consumer goods. It is also predicted that demand for electricity will increase. Vehicles will likely experience changes in energy usage, although the methods are not yet certain. Vehicles may be powered by electricity, hydrogen, biofuels, natural gas, or other innovations. Committee members also recognized that there is sufficient natural gas to provide for the state’s needs for the next decade without serious challenges, except concerning the distribution network.

All sectors of the economy are impacted by scientific and technological advances that affect natural resources, transportation, telecommunications, and vertical infrastructure. Growth in other industries has an effect on usage patterns and demand, especially with regard to telecommunications through cellular phone towers, new server farms, and other business

needs. The group agreed that as energy technology changes, it will impact the need to construct and retrofit buildings that adapt to new energy sources, depending on the best technology in the future. The Sector Committee also recognized the issue of the need to balance development of energy infrastructure with concerns about health and competition with other states involved in energy production.

There is a need for infrastructure enhancements and a readily available, trained, and educated workforce to support the energy future.

In order to sustain growth of Iowa-based energy sources, the state must have an intellectual infrastructure that provides the base necessary to support transformation in the overall economy and the institution of new technologies into the system related to energy innovation. This includes a skilled and adaptable workforce, research and development, early stage commercialization, and access to technology through broadband. The workforce infrastructure is present, but is not at full capacity due to a need for a vision, coordination, and information. Further, the energy workforce is aging, and with that, institutional knowledge is leaving the industry while the state suffers from a lack of instructors to teach new energy professionals. This uptick in technology in Iowa attracts students from other states, which is presenting an opportunity to begin to build a critical mass of human infrastructure.

There has been a notable response from community colleges and educational institutions to create programs around energy developments, and there is a well-developed research capacity at Iowa's Regents Universities. Many cite barriers to building this new workforce as a low current demand for these positions. As the energy industry grows, needs change faster than programs can be created, accredited, and adjusted. The provision of new educational opportunities is not lacking but will need to grow through incentives and partnerships in order to meet future demand. Opportunities for education and research were recognized in the area of energy innovations. The Committee noted that the state should focus on attracting funding for additional research and coordinate workforce, education systems, and industry. Making investments in any infrastructure project poses risks, but the group agreed that state-led investments could mitigate risks, create shared visioning, and pave the way for new public-private partnerships in Iowa-based energy source development.

Iowa has a substantial existing infrastructure that needs to be considered.

Iowa has already taken steps to improve the state's energy future and has experienced some early success. For example, Iowa supplies 25 percent of the nation's renewable fuels, providing more ethanol to the nation than any other state, and comes in second in the nation in wind energy supply to the country. The Sector Committee members recognized that much of the current infrastructure is aging and as the state increases its production and potential export capacity, existing transport infrastructure will continue to be stressed at a time when needs for all existing infrastructure are growing. As the state has invested significantly in areas supported by a small population statewide, existing structures will play an important role in consideration of future projects. Existing structures and technologies will need to be retrofitted to save costs and maximize opportunities to re-use the infrastructure that is already in place. The Sector Committee agreed that wire, rail, transmission structures, and roads are the highest priority portions of the current infrastructure that need to be strategically maintained. Not supplying adequate transport and technology support threatens core facilities located in rural areas. This

poses the greatest threat to innovation and agility in maximizing future opportunities for energy export and independence.

The Committee recognized that Iowa's farm-to-market commodity system is a model for the Energy Sector, and the state's road maintenance practices provide easy transport for some energy products. The state's rail capacity was viewed by the Committee as a barrier for growth in biomass collection and recycling. Concerns were explored regarding loss and age of the state's rail system, including the need for greater efficiency in rail transport, lack of staging area capacity, and shortage of available rail cars. The Sector Committee acknowledged that the current transport system for energy does not have the capacity to support innovation, such as investments in cost-effective smart grid technology or Advanced Metering Infrastructure (AMI) systems that could affect energy consumption and conservation practices.

The Energy Sector Committee recognized the need to identify Iowa's limitations in relation to energy infrastructure. For instance, the state's capacity for hydroelectric power is limited due to the topography of Iowa's rivers. Also, Iowa's geologic makeup is not ideal for the porous qualities of rock layers involved in carbon capture. It is helpful to recognize these limitations in order to determine the energy sources that are ideal for the state. Also, the Committee noted that infrastructure should be seen as an investment in the industry and in Iowa's future energy independence. Energy industries have taken the lead on creating efficiencies in production to mitigate carbon outputs in advance of anticipated increases in production volume.

Along with the need to assess existing infrastructure, the group stressed strategic changes in energy processes that may provide new, more efficient, and environmentally friendly ways to use it. Currently, the biofuels industry needs more rail capacity to support the increased number of products that will need to be transported in the short-term. If less coal was used, there would be more rail capacity for biomass, which has a much smaller carbon footprint. Many noted that the public sector and private industry may have concerns about expense when mitigating the carbon footprint, but alternative energy sources, such as biofuels and recycling, create efficiencies and reduce carbon output. Larger connections concerning environmental impacts of energy production, transport, and usage will need to be continually monitored as they affect other states, as well as Iowa.

A diverse and flexible energy infrastructure is needed to support harvest, storage, transportation, conversion, access to sustainable raw materials and natural resources, and distribution.

The Energy Sector Committee recognized that the current energy infrastructure is not keeping up with supporting technology. Availability of sustainable raw materials and natural resources was cited by the Committee as a concern, as there has been a perception of competition between food and fuel. Impacts on the availability and quality of water used by the energy production process could produce concerns for natural resource management. As the biofuels industry continues to grow, access to biomass, conversion plant capacity, and distribution systems are slowing growth. The Committee also noted concerns for the state related to crop production and external regulation by other states and the federal government due to fertilizer runoff.

The Energy Sector Committee discussed that diversification of infrastructure investments would be the most appropriate way to ensure success in the changing market. As an example, the

group noted that current technology suggests the option to switch some coal plants to gas, but the system infrastructure may not be adequate to make the switch possible. If utilized, this would lower the state's carbon footprint and add additional capacity for natural gas distribution, a primary form of energy for the state at this time. It was also recognized that new energy sources will require storage capacity that Iowa does not have. The Committee agreed that Iowa's current business climate may not do enough to stimulate the new energy economy. As evidence, the Committee cited the production of products that are ready for consumption and would maximize Iowa's potential for agricultural success, but the move toward the creation of alternative products has not reached its full potential.

There is also a lack of infrastructure to make it easy for the public to change the way that they use energy. People do not understand how to access information to make decisions about energy efficient technologies for appliances and in building new structures. Other sectors that play a strong role in transport, information sharing, and systems must be integrated into the plan for diversification of energy. As natural resources are utilized for energy production, the demand must be balanced with sustainable practices, such as leaving some biomass on the ground to prevent runoff even though it could be used to supply fuel.

Being the first to market provides great advantage for the state. The agility of the energy industry to take advantage of innovations is challenged by an aging transportation infrastructure and a culture of non-innovation, due to increased fear of cost of those building new structures. In order to remain agile and take advantage of the latest technological advances, all residents will need access to broadband technology, or potential uses will go un-implemented in parts of the state where rich natural resources are located.

Leveraging rail, railroads, wires, pipelines, and rivers is critical to maximize the transmission and transport of energy.

Overall, Iowa is a net importer of energy when taking into consideration natural gas, electricity, and coal. Many cite issues with the current capacity of transportation and exporting mechanisms as missed opportunities for growth in Iowa's economy. The energy sector utilizes all current forms of transport systems available today. The Sector Committee recognized that the comprehensive transportation and distribution system for energy in the state is not conducive to exporting energy. This is a missed opportunity for growth and recovery in Iowa's future economy. Focuses on pavement, under-use of rivers, and increasing stress to the current grid structure were all cited as major infrastructure concerns.

The Sector Committee stressed that unlike other areas of the economy, growth in Iowa-based energy sources will require a strong rural development component to meet workforce needs in wind and biofuels production and distribution centers. To transport these energy sources and begin to export more energy from the state, it will be important to keep existing transport infrastructure systems operational and make investments in new technology to meet future demand. It was agreed that prioritization for funding is the key, along with strategic planning. Some expensive items, such as buying rights of way, can be used for more than one mode of transport or distribution, as long as planning is included. Also, the group addressed transmission specifically as it relates to planned growth in electric usage over time.

Opportunities for leveraging technology and the availability of rail, wire, pipeline, and river infrastructure are challenged by required technology investments and maintenance from the

transportation, natural resources, and telecommunications sectors. The Sector Committee recognized that increases in production of Iowa-based energy would translate into increased transportation needs and associated costs for investments and upkeep. Also, as energy sources are developed around the state, Iowans will increasingly expand the number of vehicle miles traveled. Concerning natural resources, many processes for energy production require water. Currently, Iowa's telecommunications system cannot support the necessary capacity for expanded electricity coverage to meet needs, as well as provide rural residents with opportunities to live and work remotely. Members of the Energy Sector Committee noted that portions of the energy transportation and distribution system in the state are constrained due to lack of capacity in certain areas, which further stifles growth into new arenas. The current energy infrastructure is not designed to handle additional loads and emerging needs for storage, distribution, and demand technologies.

Customer behavior has a large impact on energy use and efficiency.

Members of the Sector Committee recognize that customers expect reliable, safe, affordable, and environmentally responsible energy. As consumers in Iowa demand even more technology for their employment, entertainment, and daily living needs, energy usage continues to rise. In order for the state to remain globally competitive and to rebuild from the natural disasters of the summer of 2008 in a more efficient way, consumers play a large role in personal and business infrastructure, behavior choices, and investments made. The group noted that the largest barriers to behavior change are cost and motivation.

Although millions of dollars have been invested in energy efficiency programming, electricity usage in the state continues to increase. The Sector Committee reflected that there is often pressure faced by public entities to have a return on investment for energy systems; however, many new technologies that are available, such as solar, may not see a substantial return on investment for 20 years. The challenging connection to individual energy usage and climate change is also a priority for consideration, as environmental protection and bolstering the economy can appear at odds when considering the short-term return on investment. The need to remain globally competitive with emerging economies such as China and India indicates that investments in clean technology are also a priority.

Sector Committee members noted a challenge in changing consumer behavior while balancing the implications of usage and energy efficiency with quality of life. It was agreed that currently, not enough financial incentives are available, and many are not aware of opportunities for learning about and financing these types of improvements. Opportunities to find ways to change consumer behavior include making energy efficiency a less expensive and more convenient option. As an example, the rising cost of oil may increase the demand for hybrid vehicles. Conversely, making energy saving measures increasingly convenient and influencing consumer demand may also produce changes in consumer behavior and energy use. For instance, if businesses changed their operational structure and began utilizing telecommuting hubs, the number of vehicle miles traveled would decrease as people work closer to home.

Current demand for energy and any changes in consumer behavior are dependent upon the existing and growing transportation, telecommunications, vertical, and natural resource infrastructure systems. Each could be affected by consumer usage changes and changes in demand. If Iowans decrease their vehicle miles traveled or change to a different fuel source for vehicles, the distribution capacity and road use tax funds availability and prioritization structure

may be affected. Buildings and vertical infrastructure issues may arise concerning zoning and space for the way that buildings and vehicles access energy. The Sector Committee also recognized that the telecommunications system in the state will need to be updated to assist with changes in trends and usage of energy throughout the state. Concerns about land use and sprawl, in addition to limiting carbon output through new technology, will also be important considerations for Iowa's natural resources.

Recommendations

The Energy Sector Committee has put forward five recommendations to address the issues that Iowa faces in energy production, transport, storage, distribution, and usage. The recommendations overlap, as the issues are intertwined. As part of discussions, the Energy Sector Committee emphasized the importance of future economic development, disaster recovery, and the impact to and from the energy sector, with regard to the Transportation, Telecommunications, Natural Resources, and Buildings and Vertical Infrastructure Sectors. These considerations, as well as explanations from discussion, are outlined below.

There should be a system to support an energy literate population in Iowa through education and information on implementing solutions to meet energy goals.

This recommendation addresses the following issues:

- Energy production and usage patterns are continually evolving, and while certain aspects of the energy future remain unclear, some trends are already known.
- There is a need for infrastructure enhancements and a readily available, trained, and educated workforce to support the energy future.
- Customer behavior has a large impact on energy use and efficiency.

Since consumers will ultimately drive demand, it is imperative that they know and understand energy information. As they become more comfortable with these concepts, people will start to expect to have greater control over their energy use and costs, especially considering the advent and further development of smart grid and Advanced Metering Infrastructure (AMI) technologies. Through the creation of an energy literate population, consumers will be empowered to make energy decisions and begin to demand cleaner, more sustainable practices in the industry. This can be accomplished by providing education, systems to incent best practices, and to support transitions in the implementation of new energy technologies into homes and businesses around the state.

The Energy Sector Committee's discussion centered on the need to educate and inform the public. With the recognition that there is money to be made when consumers are educated about energy efficiency, in that vendors and home builders will be more likely to be utilized to replace inefficient appliances and home features, consumers ultimately benefit. For instance, the current consumer may be more likely to buy a less expensive, inefficient appliance because of upfront costs, without considering the life-cycle costs associated with inefficiencies. The Committee also recognized that common building codes that support energy efficiency and proper enforcement would add to success in creating a coordinated system of support and education. When organizations are motivated to provide customers with the information they need to make informed decisions, it is of benefit to society as a whole. Usage can drive change when people fully understand what energy means.

An energy literate population takes advantage of opportunities for energy efficiency, which decreases costs to businesses and families through decreased waste. This, in conjunction with the use of renewable energy, increases energy independence. Additionally, an energy literate population may start demanding that energy production and transport develop in a way that allows utilization of diverse energy sources, financial investment strategies, and new

technologies in their communities. A full information structure allows disaster rebuilding efforts and hazard mitigation to be forward thinking and intentional, in order to maximize the opportunity to rebuild in a way that incorporates energy considerations. It is important to create a culture of seeking new opportunities with youth and children, both in their own usage and future workforce opportunities. Educating students or children and youth in science and math has the potential to make Iowa's workforce more adaptable for the energy future.

The ability to utilize information and technology in rural locations enhances Iowa's agricultural and biofuels opportunities. With farmers' need to engage with the world as international business people, broadband access will be crucial to the farmer's ability to access information for their subsequent success. In some areas, access to broadband is currently unavailable due to profitability concerns on the part of broadband providers. However, rural connectivity will be crucial to the success of the Iowa economy and its dependence on agriculture. With new technologies constantly evolving, such as those that assist in fertilizer application, there will be implications for the production and transport of biofuels. Additionally, the technologies used to assist in targeted chemical application will undoubtedly have implications for natural resources, such as less runoff and use of fewer chemicals.

There should be a business climate and stable government investment structure that responsibly supports energy technology research, development, demonstration, and deployment. This structure would include policy and financial incentives to support all phases of development from early stage commercialization to the marketplace.

- Policy and financial incentives in these areas should reflect both environmental and cultural factors.
- This will require easy access, influence, and capitalization of federal opportunities and policies that benefit the state and nation.
- Iowa should be a leader in the global economy through lower energy costs and innovation.

This recommendation addresses the following issues:

- Energy production and usage patterns are continually evolving, and while certain aspects of the energy future remain unclear, some trends are already known.
- There is a need for infrastructure enhancements and a readily available, trained, and educated workforce to support the energy future.
- Iowa has a substantial existing infrastructure that needs to be considered.
- A diverse and flexible energy infrastructure is needed to support, harvest, storage, transportation, conversion, access to sustainable raw materials and natural resources, and distribution.
- Leveraging rail, wires, pipelines, and rivers is critical to maximize the transport and transmission of energy.

A changed business climate and corresponding infrastructure would allow new opportunities for Iowa, including the ability to invite innovation. Stability in policy decisions through common and strategic visioning is a priority among the business community, so the infrastructure investments they have made are applicable for the long haul within the context of regulatory certainty. There is a need to create a business and policy environment that supports a robust, diversified transport system to serve Iowans' overall needs as well as the export of energy. One Committee member recognized that research and development is often put into silos by technology. For example, at the Department of Energy, the solar, biomass, and wind programs are separate

from one another. This can create a challenge in making policy. When there are so many areas of innovation and research, it is hard to know where to invest and what to support as a state. This recommendation encourages public-private partnership, which could net a very strong economy. It also mitigates the risk involved for business in making investments and trying to anticipate which energy sources will be favored. Incorporating a system-wide process for planning and cooperation in investment will ensure that private and public partners have a common vision and understanding of the energy infrastructure needs for the future. Additionally, Iowa will continue to attract and grow business and investment opportunities by keeping energy costs competitive with other states. Although the Sector Committee recognizes that innovation will require investment, it is anticipated that energy infrastructure investments will be made strategically so that upfront costs can be recovered.

There is a need to provide balance for responsible practices with regard to the environmental implications of the energy sector as well. Iowa's economy depends heavily on the availability of sustainable natural resources, and it will be essential to consider this factor. One need is the infrastructure to support harvest, storage, transportation, conversion, and access to biomass, along with distribution. Land use patterns have involved abandonment of areas, and building out means more roads and greater distance traveled, which contributes to quality of life concerns. Striking a balance between development and allowing use of agricultural land will contribute to the success of the bioeconomy. Farm to market roads will continue to be needed for increased agricultural outputs that also fuel the energy sector. In addition, as telecommunications systems age and are continually stressed, cyber security of energy is a concern.

The Sector Committee noted the need to create a business climate to produce products that are ready for consumption to maximize Iowa's economic potential. Policy and incentives were suggested to be supportive of new, Iowa-based, clean energy opportunities that are in development or growth periods, such as wind transmission. Additionally, the cultural and quality of life elements of the energy future should be considered in order to attract and retain Iowans.

There should be recognition that Iowa's primary resources (soil, water, wind, and an educated, motivated workforce) provide value-added opportunities throughout the state, and that capitalization requires consideration for the state's diverse communities and sustainability.

This recommendation addresses the following issues:

- Energy production and usage patterns are continually evolving, and while certain aspects of the energy future remain unclear, some trends are already known.
- There is a need for infrastructure enhancements and a readily available, trained, and educated workforce to support the energy future.
- Iowa has a substantial existing infrastructure that needs to be considered.
- A diverse and flexible energy infrastructure is needed to support harvest, storage, transportation, conversion, access to sustainable raw materials and natural resources, and distribution.
- Leveraging rail, wires, pipeline, and rivers is critical to maximize the transport of energy.

For purposes of this report, value-added opportunities are those that provide opportunities for collaboration and utilization of existing and expanding technology and resources. For instance, technology has allowed Iowa to maintain the number of farmed acres while increasing yields, and this has been advantageous to the state's economy.

It is crucial to have the infrastructure to support these opportunities and the economic results they provide for the state. The Iowa economy depends heavily on natural resources that produce energy, directly and indirectly. Soil, water, and wind provide resources through which Iowa can become increasingly energy independent and an exporter of energy. Additionally, when considering sustainability and the ability to harness energy potential, opportunities to recycle materials will be critical. Recognition of the value-added opportunities that Iowa's resources provide will enable the state to continue to make smart investments. One such example is the system for farm to market roads that enables the goods produced in rural Iowa to reach the rest of the state, national, and international markets.

The potential economic impacts of having access to natural resources of high quality are great. With this access, Iowa can attract new energy investments. Having a workforce that is already trained or has access to quality training opportunities through innovative programs in community colleges and Iowa's regents institutions will be a key selling point to businesses looking to relocate to Iowa. Energy jobs provide well-paying work opportunities that match Iowa's strong work ethic and skilled workforce.

Supporting strong rural infrastructure enables the success of the entire state. For instance, ensuring that telecommunications systems are in place for the Iowa economy to be connected to the global economy will be essential. It will be important to make certain that existing buildings and other facilities are retrofitted and new buildings and facilities are built to support growth, including their sewer, water, and other systems. Finally, when thinking about the impacts on disaster recovery, there is a need to protect natural resources and mitigate future damage to them. By utilizing biofuels, the state will be able to take full advantage of the life cycle of its natural resources.

There should be a recognition that infrastructure policy decisions must provide balance for the needs for stability, flexibility, and agility, while appropriately valuing current infrastructure.

This recommendation addresses the following issues:

- Energy production and usage patterns are continually evolving, and while certain aspects of the energy future remain unclear, some trends are already known.
- Iowa has a substantial existing infrastructure that needs to be considered.
- Leveraging rail, wires, pipeline, and rivers is critical to maximize the transport of energy

Policy decisions have to be well thought-out and responsible when energy infrastructure is developed and implemented. With the energy future, it will be essential to invest in common denominators to make innovation successful. For instance, there may be a need to serve electric vehicles if that is a direction taken by the auto industry and the public. In this case, investment may need to be made in building an electricity infrastructure along roads, perhaps building on existing infrastructure at gas stations and rest stops. Additionally, buying rights of way can be coordinated with other investments, as long as planning is included in the process. Other examples of common denominators include utilization of home heating systems that can take advantage of multiple energy sources, biofuels, recycling, and retrofitted pipelines. In order to keep existing built infrastructure viable, there is a need to find new ways to fund infrastructure that consider sustainability. There is also a need to recognize the opportunities for investment on a small scale to test energy solutions.

One approach that the Energy Sector Committee identified as critical to maximizing energy transport and transmission is leveraging rail, wire, pipeline, and rivers. The transport of people and goods, such as through the use of roads, sometimes coincides with energy transport, and sometimes they do not work as well together, or opportunities for their shared usage are missed. It will be critical to take stock of current infrastructure and keep the elements in place that serve the state's economic success. As the Energy Sector Committee noted, all elements of the current infrastructure will be critical to a diverse energy sector. The group discussed the potential to put a moratorium on divesting of rights of way as a means to encourage multi-modal transport. There was also discussion of the development of regional processing centers, such as biorefineries and mini-mills, in order to be centrally located to serve the end user or to optimize the transport of raw biomass materials.

The committee recognized the need for both stability and flexibility when making infrastructure policy decisions. There is a need for stability to enable businesses to anticipate laws and regulations and react accordingly. Also, there is a need for adaptability within decision making to consider new technology and innovation. Similarly, group members noted the importance of balancing the need to prioritize with the need to invite and understand the market. When considering the value of current infrastructure, it should also be noted whether current infrastructure can be maintained based on funding sources.

There is a need to recognize the implications that this recommendation has on disaster recovery, economic development, and the other sectors. Disaster recovery provides an opportunity to adapt to changing infrastructure and technology needs. The need for stability for businesses to be able to react to and anticipate needs is crucial to their success in the Iowa economy. If the rules and regulations are always changing, business finds it difficult to navigate profitably. Additionally, it will take an adaptable infrastructure to increase the economy around the state so Iowa can be on the forefront of new developments.

Within the transportation system, there is a need to appropriately value current infrastructure, as well as consider the capacity to retrofit buildings and other vertical infrastructure. Additionally, the investments made in the telecommunications backbone should be utilized to create opportunities for future needs.

There should be coordinated outreach in energy efficiency across sectors, establishing Iowa as a leader in best practices.

The final recommendation addresses the following issues:

- There is a need for infrastructure enhancements and a readily available, trained, and educated workforce to support the energy future.
- Customer behavior has a large impact on energy use and efficiency.

This recommendation incorporates two primary areas of emphasis – personal and business energy usage. Promotion of energy efficiency best practices brings awareness to businesses, consumers, and vendors. Ideally, it also allows people and businesses to save money on their energy bills, which has huge implications for a sector such as advanced manufacturing. Information on the return on investment is necessary for people to make informed decisions. Competition can also provide a healthy environment for behavior change. For instance, in

Massachusetts, utilities publish neighbors' energy usage on consumers' bills, and this effort has affected the motivation to implement energy efficient practices positively.

Iowa has the opportunity to model energy best practices with funding by encouraging communities to build buildings that are more efficient. The Vision Iowa Fund adopted an energy efficiency best practice, and in communities these investments have been an example to educate others in the benefits of green buildings, serving as a way to raise additional money, and helping communities to think about energy efficiency. Similarly, Iowa can serve as a national leader in energy efficiency best practices. Iowa is a perfect state to serve as a leader in energy because of its rich natural resources, the work ethic of its citizens, and the state's strong history of investment in the energy development process from research to early stage commercialization.

Iowa's electric and natural gas utilities have made considerable investments and have implemented planning to improve energy efficiency through home energy audits and other resources. By leveraging this investment and planning, in addition to other avenues to improve energy efficiency, Iowa will be successful in utilizing solutions that can serve as a national model and as a tool for building public will. For example, through community college programs in HVAC (Heating, Ventilating, and Air Conditioning), the state has an opportunity to utilize communication to prospective customers about energy efficient appliances, in addition to countless other possibilities. By improving insulation and windows, it can decrease the need for large heating and cooling systems, and making future technicians and contractors aware of this issue is imperative. Purchasing decisions affect the amount of energy used and commodities, and the goal is to help guide those decisions. Additional promotion of national initiatives, such as the Energy Star program, and coordination with utilities' efforts to increase efficiency will be helpful as consumers become increasingly familiar with opportunities for energy efficiency.

When considering the impact on the economy, disaster recovery, and other sectors, positioning Iowa as a leader in energy efficiency helps businesses and consumers save money, brings Iowa to the forefront of the national discussion, and promotes ideas and innovations in the state, which will ultimately attract businesses. Disaster recovery creates opportunities to put energy efficiency into practice during the rebuilding process. Smart grid technology may enable consumers to conserve natural resources through informed decisions about the use of energy. With improvements to infrastructure, less water will be wasted in distribution. In order to enable the use of these technologies, telecommunications and access to broadband will be a crucial factor.

Lastly, the Energy Sector Committee also recognized the need to increase compliance with current building code standards. Iowa has the most extreme climate differences in humidity and temperature of any state in the country, which places unique demands on buildings. If energy efficiency is possible in Iowa, it can be duplicated in states with less extreme weather.

Infrastructure Planning Process

Across Iowa, economic strength and competitiveness depends, in part, on our state's infrastructure. In his 2008 Condition of the State address, Governor Chet Culver highlighted the need for a statewide infrastructure plan to ensure all of Iowa is ready for the economy of the future. At that time, Iowans could not have foreseen the tragic disasters of 2008 or the seriousness of the economic recession, but their impacts underscored the need for integrated and strategic priorities for Iowa's infrastructure in future years.

Those challenges resulted in a short-term infusion of more than \$6 billion for Iowa over a three-year period through the American Recovery and Reinvestment Act (ARRA), I-JOBS, and federal disaster recovery funds. These funds are being spent effectively and as expeditiously as possible on clear priorities for disaster recovery, jobs creation, economic recovery, and other infrastructure and non-infrastructure priorities for the near term.

Iowa also must be poised for the longer-term through strategic and visionary planning for the economy of the future. Iowa needs to continue to make investments in infrastructure, seeking value and success competing in an international economy. The planning process builds on the significant impact of past and current initiatives, opportunities, issues, and challenges.

Iowa Department of Economic Development (IDED) was charged with developing a plan for Iowa. Funding for the planning initiative was provided by the United States Department of Commerce, Economic Development Administration as part of the disaster recovery grant to the State of Iowa. Under a competitive Request for Proposals process, State Public Policy Group, Inc. (SPPG) was awarded a contract for managing, facilitating, and developing the issue-focused plan under the direction of IDED and project director Thomas W. Hart.

The planning activities span August 2008 through April 2010, when the statewide plan for infrastructure to support Iowa's future economy will be completed. The process for developing the infrastructure strategy was designed to challenge and encourage Iowans to suggest approaches that link infrastructure sectors and position Iowa to shape and fully participate in the economy of the future. With guidance from state leaders in the five sectors of focus, stakeholders with a diversity of perspectives and experiences from across Iowa were engaged in the activities to develop an issue-focused plan with relevance to the public, private, and nonprofit sectors throughout the state.

Five sectors of focus were determined by IDED: Buildings and Vertical Infrastructure, Energy, Natural Resources, Telecommunications, and Transportation.

Leadership of the project was provided by a Sector Chairs Group, which was comprised of state agency directors representing each sector. Sector Chairs met regularly throughout the planning process to ensure consistency in the work of each Sector Committee and to address overarching issues. The following individuals serve on the Sector Chairs group working closely with IDED and SPPG:

- Thomas W. Hart, Iowa Department of Economic Development, Project Director, Sector Chairs Group Chair, and Task Force Chair

- Joseph Cassis, Iowa Communications Network, Telecommunications Sector Committee Co-Chair
- Steve Fleagle, The University of Iowa, Telecommunications Sector Committee Co-Chair
- Richard Leopold, Iowa Department of Natural Resources, Natural Resources Sector Committee Chair
- Bret Mills, Iowa Department of Economic Development, Buildings and Vertical Infrastructure Sector Committee Co-Chair
- Joe O'Hern, Iowa Finance Authority, Buildings and Vertical Infrastructure Sector Committee Co-Chair
- Nancy J. Richardson, Iowa Department of Transportation, Transportation Sector Committee Chair
- Roya Stanley, Iowa Office of Energy Independence, Energy Sector Committee Chair

Additional individuals with special expertise related to the planning initiative participated on the Sector Chairs Group and the Task Force:

- Elisabeth Buck, Iowa Workforce Development
- Emily Hajek, Rebuild Iowa Office
- David Miller, Iowa Homeland Security and Emergency Management Division
- Jon Murphy, Iowa Office of the Governor

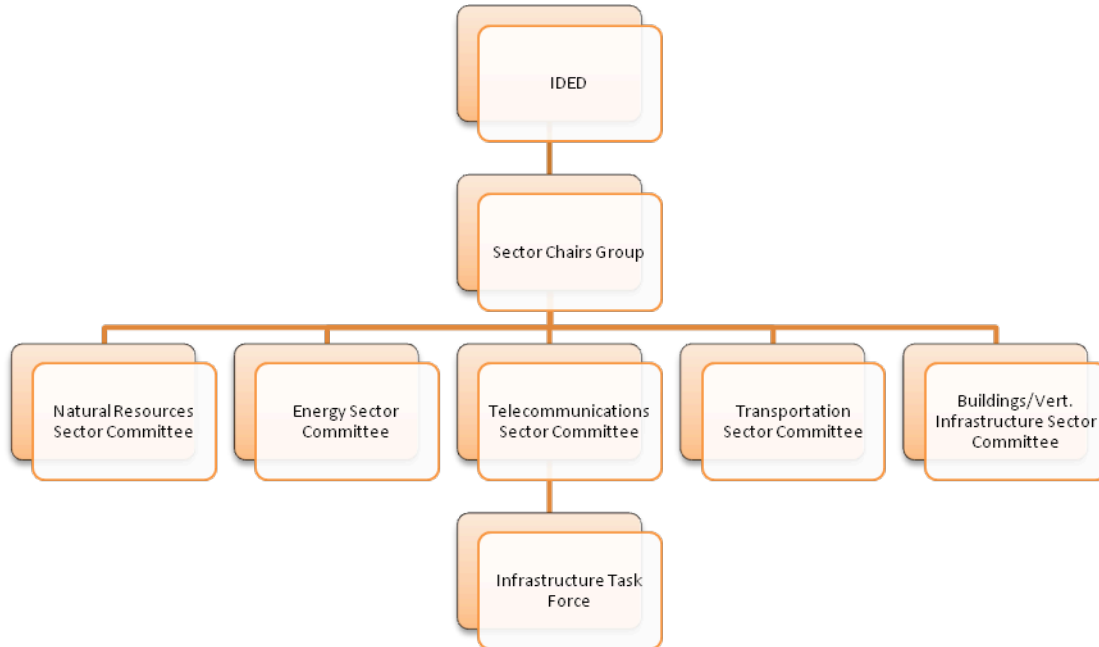
Each Sector Committee met four times in day-long deliberations between November 2009 and February 2010. Sector Committee membership was comprised of private, academic, issue-based, and public representatives providing a diversity of perspectives and strategic vision. Each committee was chaired by the respective member(s) of the Sector Chairs Group. Each of the five Sector Committees was responsible for defining the sector for purposes of this initiative, identifying issues, and developing recommendations based on research, experience, and information reviewed by each committee. Sector Committees were also charged with considering each sector's interaction and integration with the other sectors. Sector Committees were guided by the Essential Elements of Iowa's Future Economy and the common understanding of Iowa's economic situation and forecast described earlier in this report. The findings of each sector were detailed in five separate Sector Committee Reports.

Six community forums were held in Johnston, Coralville, Ottumwa, Dubuque, and Sioux City, with an ICN session conducted at 10 sites statewide. ICN sites were in Atlantic, Carroll, Clinton, Council Bluffs, Creston, Dubuque, Fairfield, Mason City, Storm Lake, and Urbandale. The forum in Dubuque was canceled due to winter weather, but it was rescheduled as an ICN forum. These community forums were structured to elicit public input regarding the initial issues and ideas developed by the Sector Committees and to inform the process going forward. Comments and suggestions from stakeholders proved very informational and beneficial to the overall process. The input from these community forums was integrated into each Sector Committee Report and Recommendations. Sector Committee reports were completed by March 1, 2010, and forwarded to the Task Force.

The Infrastructure Planning Task Force is charged with developing the statewide strategic plan and outlining priorities to achieve a strong and competitive economy. The Task Force, chaired by project director Thom Hart, includes all members of the Sector Chairs Group and several

individuals from each Sector Committee and will meet three times during March and April. The plan and recommendations of the Infrastructure Task Force will be presented to IDED in May 2010.

Below is a graphic depiction of the relationship of all components of the process for developing the Infrastructure Strategy for Iowa's Future Economy.



The Infrastructure Strategy for Iowa's Future Economy will outline the Task Force's consensus direction for Iowa's buildings and vertical infrastructure, energy, natural resources, telecommunications, and transportation as sectors integrate with one another and as they impact the economic strength and competitive position for Iowa. This information should be of practical value to policymakers at all levels, state and local government agencies, the private sector, non-profit organizations, issue-based organizations, and the public.

The planning process created a clear understanding that Iowa's infrastructure as it exists and is funded today is neither sustainable nor affordable. The Infrastructure Strategy provides insights for all stakeholders as they shape their future.

Conclusion

Members of the Energy Sector Committee have noted the need for agility, diversification, and prioritization for infrastructure needs. The Committee was charged with taking a hard look at how the sector is currently operating, what can be improved, and how Iowa may fall short of meeting goals regarding infrastructure. Iowa's energy future stands to be very bright, and reaching that success will require the appropriate strategic investments in infrastructure. As plans are developed during the Infrastructure Strategy Task Force process, the importance of coordinated planning between sectors should be noted. Efforts in coordinated planning should be followed by coordination in implementation. Sectors must work together to identify priorities to ensure growth and success for each and avoid delay of innovation and opportunities. Only through this coordinated, comprehensive approach can energy innovations and opportunities be realized in the overall goal of Iowa's growth, prosperity, and recovery.

Supporting Documents

Meeting Notes

- November 17, 2009
- December 17, 2009
- January 21, 2010
- February 24, 2010

Presentations to the Energy Sector Committee

- Utility-Grade and Residential Solar Applications and Solar and Battery Technology Advances
- Current Nuclear Generation Technology
- Advanced Coal Technology