IOWA ENERGY ASSESSMENT AND PLANNING FOR A CLEANER FUTURE

Author
Paritosh A. Kasotia
Founder and CEO
Unfolding Energy
February 27, 2016

About Unfolding Energy

Unfolding Energy educates, informs, and provides solutions on clean energy choices and its impact on the climate.

Unfolding Energy**,** a not-for-profit organization is founded on a premise that clean energy choices can safeguard the climate as well as create economic growth. But, this requires a government that is willing to support the growing industry, a consumer base that is educated and engaged, and an industry that openly embraces the changes and works towards integrating new technologies into the energy mix.

With that, Unfolding Energy helps its partners make sense of the ever-changing energy industry. Learn more at www.unfoldingenergy.org

About the Author

Paritosh (Pari) Kasotia is the Founder and CEO of Unfolding Energy. She spent many years leading the Iowa Energy Office at the State of Iowa where she undertook a number of clean energy programs. Of these, she spent the last three years playing an official lead role in managing all the undertakings of the Energy Office. She successfully managed the American Recovery and Reinvestment Programs (ARRA) and the Iowa Power Fund Program, in addition to other federal and state energy programs.

As the Energy Lead at the Iowa Energy Office, Pari worked relentlessly to promote energy efficiency at the municipality and institutional level. She formed successful partnerships with various organizations, most notably the Iowa Association of Municipal Utilities (IAMU) which drove demand for energy efficiency at municipality level, and the Iowa Energy Center on the Iowa Public Buildings Benchmarking Program. She also partnered with the Iowa Area Development Group (IADG) to establish a low-interest rate loan program for clean energy projects, a program highly successful in providing low-cost financing for solar PV projects.

Use of this Report

It is Unfolding Energy's hope that the State of Iowa, elected officials, Iowans, potential political candidates, and others will utilize this report to guide their planning process especially as the Iowa Energy Office works towards establishing a statewide energy plan.

For any questions, corrections, or updates, please contact the author by clicking here.

Contents

Executive Summary

Iowa has established itself as a leader in energy conservation and clean energy over the last three decades. Iowa is widely recognized for its wind and biofuels production and its exemplary utility-led energy efficiency programs. This report explores how Iowa can continue on its path to energy independence and also lead in addressing the global crisis of our time — climate change.

Iowa demonstrated its climate leadership in 2007 when the Iowa Legislature adopted the SF 485 which established the Iowa Climate Change Advisory Council (ICCAC) and directed it to establish a system for reporting and monitoring greenhouse gas emissions and develop scenarios for reductions by 2050.

While the ICCAC was discontinued in the recent past, Iowans have made clear their preferences for energy choices. In a statewide voter survey conducted by a bipartisan research team, it was found that Iowans overwhelming support energy efficiency and clean energy choices.[i] Moreover, clean energy markets have significant job impacts. According to Advanced Energy Economy (AEE), Iowa currently boasts 22,000+ clean energy jobs. AEE's survey also projects a 6% job growth in 2015.

Apart from the economic case for expanding Iowa's clean energy sector, the climate change argument is increasingly more urgent requiring immediate attention. Natural disasters events and the resulting economic losses as a result of climate change are well documented. According to Iowa Climate Change Impacts Committee Report to the Governor and the Iowa General Assembly, Iowa is already experiencing the negative effects of climate change.[ii]

The economy is also witnessing a new phenomenon where the economic growth is visibly decoupling from energy consumption. Traditionally, the US economy, energy consumption and the resulting greenhouse gas emissions have shown direct and upward relationship. However, data now suggests that this relationship is disconnecting — partly due to energy efficiency and addition of renewable energy in the energy mix. The US Department of Energy data shows that the energy consumption is decelerating which is in contrast to a growing economy and a growing population.

As Iowa develops its statewide energy plan, the state of Iowa must include low-cost and easy to implement measures that will help Iowa achieve energy independence, create jobs, and strengthen local economies. Some of these recommendations detailed in the full report are:

- Strengthen renewable portfolio standard with carve outs for solar and CHP
- Strengthen current policy framework to promote clean energy technologies
- Promote energy efficiency and conservation programs
- Strengthen building codes and compliance
- Establish clean energy investment fund
- Create a statewide public education program on energy

By adopting these measures and other sound polciies and programs, Iowa can lead the nation and help create a clean energy economy.

Iowa Energy Overview

Iowa has established itself as a leader in energy conservation and clean energy over the last three decades. Iowa is widely recognized for its wind and biofuels production and its exemplary utility-led energy efficiency programs. This report explores how Iowa can continue on its path to energy independence and also lead in addressing the global crisis of our time — climate change.

Energy Production

Iowa's primary electricity source is coal which is imported from Wyoming by rail. 60% of Iowa's energy is produced from coal-fired plants. Iowa also operates one nuclear power plant, Duane Arnold which provides approximately 8% of the state's electricity.

Iowa is one of the leading nations in producing clean energy. Currently, over 28% of electricity produced in Iowa comes from wind. Most of Iowa's wind farms are located in the northwest and the north-central region. Iowa has made great strides in its wind energy sector where the industry now supports 6,000-7,000 jobs.

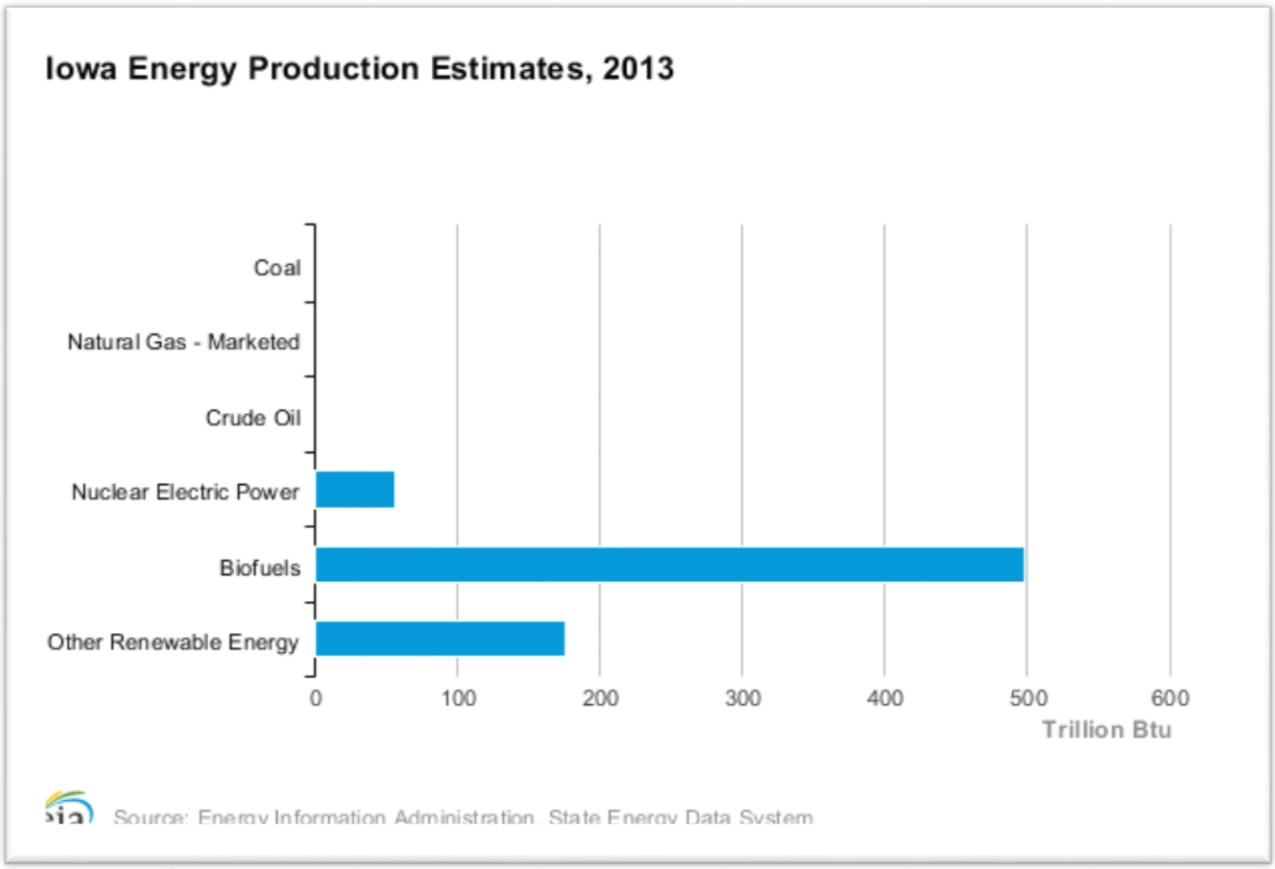

FIGURE 1: IOWA ENERGY PRODUCTION ESTIMATES, 2013

On the transportation side, while Iowa does not produce any fossil fuel, it is the largest producer of ethanol in the US, accounting for 28% of the nation's fuel ethanol production.[iii] Approximately, 476.3 trillion btu of ethanol was produced based on 2012 statistics.[iv]

Energy Consumption

Iowa is primarily a fossil fuel consuming state despite significant in-state wind energy production. Coal and natural gas are the leading energy sources followed by ethanol, biomass, and renewable energy. According to 2013 estimates, Iowa consumed 402 trillion Btus of coal and 307 trillion Btus of natural compared to 150 trillion Btus of renewable energy.

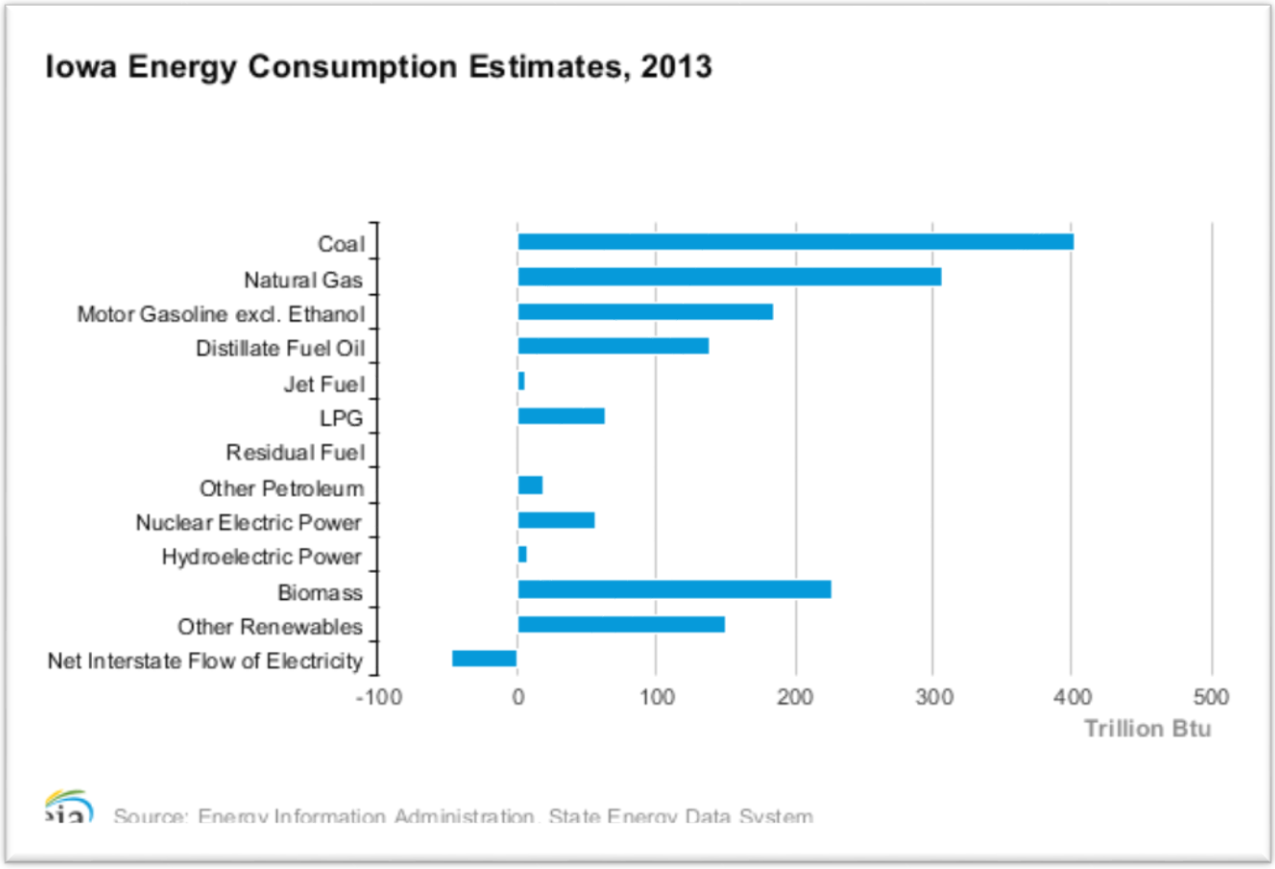

FIGURE 2: IOWA ENERGY CONSUMPTION ESTIMATES, 2013

Iowa is ranked 25th in total energy consumption with 1,450 trillion Btu of energy consumed in 2012 yet 5th for energy consumption on a per capita basis.[v] Iowa's energy intensity can be attributed to its manufacturing sector. Iowa is ranked in the top ten states that have the highest share of GDP from manufacturing. Even though Iowa's population is low, due to the nature of its manufacturing base, the industrial sector accounts for 49% of the total energy consumed.

Because of this, the greenhouse emissions are also significantly high and the state ranks 25th in carbon dioxide emissions.[vi]

Current Regulatory and Policy Framework

Greenhouse Gas Emissions

Iowa does not impose a cap on greenhouse gas emissions. Iowa has historically taken steps to address emissions even though some of these measures are currently inactive. In 2007, Iowa legislation adopted the SF 485 which established the Iowa Climate Change Advisory Council (ICCAC) and directed it to establish a system for reporting and monitoring greenhouse gas emissions as well as develop scenarios for reductions by 2050. The bill also required a report to be submitted to the governor and the general assembly each year regarding greenhouse gas emissions for previous years and a forecast on future trends. In its final report, the ICCAC proposed 56 multi-sector policy options to reduce greenhouse gas emissions. Many of these policies were cost-effective and promised significant cost savings for Iowans. However, the Council was disbanded in 2011 with no implementation of the policies.

Iowa was also part of the Midwestern Regional Greenhouse Gas Reduction Accord, a regional agreement formed by the six Midwestern states under the Midwestern Governors Association. The Accord was to establish a regional cap and trade program to reduce greenhouse gas emissions. Unfortunately, the states are no longer pursuing it.

Renewable Portfolio Standard

Iowa was the first in the nation to pass a Renewable Portfolio Standard (RPS) or Alternative Energy Production Law requiring Iowa utilities to produce 105 MW of energy from renewable energy sources. This goal was modified in 2001 and was increased to a volunteer goal of 1000 MW. Since then, Iowa has long surpassed its RPS and is currently producing over 5,000 MW of renewable energy, primarily through wind.

Energy Efficiency Resource Standard

While Iowa does not have a traditional Energy Efficiency Resource Standard (EERS), Iowa utilities have led the nation in providing energy efficiency programs to its customers. Under the Iowa Code 476.6 (17), Iowa investor-owned utilities are required to submit an assessment of energy consumption and potential savings to the Iowa Utilities Board (IUB). The utilities propose targets to IUB which, if approved, are implemented. For the 2014-2018 period, Iowa's two investor-owned utilities, Interstate Power and Light (IPL) and MidAmerican Energy set electricity goals of 1.2% incremental savings per year over this four year period.[vii] Unlike a traditional EERS, these goals are not mandated and there is no penalty for not meeting them. Iowa's municipal owned utilities and electric cooperatives are also required to develop energy efficiency programs and submit progress and final report to the IUB.

Iowa Renewable Fuel Standard

Iowa provides generous incentives for biofuels production. Incentives such as Ethanol Promotion Tax Credit, E85 Gasoline Promotion Tax Credit, and the Biodiesel Blended Fuel Tax Credit have allowed the ethanol and biodiesel industries to flourish in Iowa. However, Iowa's biofuels industry is significantly impacted by the changes in the federal Renewable Fuels Standard (RFS), policy that has created rifts between Iowa leaders and the Environmental Protection Agency (EPA) over the revision of RFS.

Building codes

Iowa has generally performed well in adopting the latest building energy codes. Iowa adopted the 2012 International Energy Conservation Code (IECC) on March 12, 2014 with an effective date of June 1, 2014. Iowa's energy codes apply statewide. However, compliance and training is a challenge due to limited resources at the state level.

Financial and Regulatory Incentives[1]

Iowa offers a suite of generous incentives to promote renewable energy industry. These include:

- *Solar Energy System Tax credits:* 18% corporate or personal tax credit for solar energy systems. Excess credit can be carried forward over ten years.
- *Production tax credits:* $0.015/kwh for ten years after a renewable energy facility begins producing energy. Facilities need to be certified by the Iowa Utilities Board and credits in excess of tax liability in a given year may be carried forward up to seven years. System size restrictions also apply.
- *Property tax exemptions:* 100% property tax exemption for solar and wind for five years and 100% exemption for geothermal for 10 years. This includes commercial, residential, industrial, and agricultural sector.
- *Sales tax exemption:* 100% sales tax exemption for most renewable energy equipment.
- *Inter-connection:* Iowa investor-owned utilities and Linn County Rural Electric Cooperative provide inter-connection for up to 100 MW of distributed generation facilities.
- *Net-metering:* Iowa investor-owned utilities offer net-metering of up to 500 kW. Customers get a credit on their utility bill at a retail rate.

Utilities also provide prescription and custom rebates for energy efficiency.

[1] While these are the most common incentives available, this is by no means an exhaustive list.

Prospects for Clean Energy in Iowa

Iowa is blessed with abundant natural resources, namely, wind, biomass, and solar, and holds immense potential for clean energy. The sections below explain each clean energy resource and its potential in detail.

Wind

Iowa is ranked 7th in the nation for wind resource. Currently, Iowa has 6,212 MW of installed wind capacity, ranking it 2nd in the nation.[viii] Over 28% of electricity generated in the state comes from wind. The Iowa Wind Energy Association has set a new goal of 20,000 MW of installed capacity by 2030.

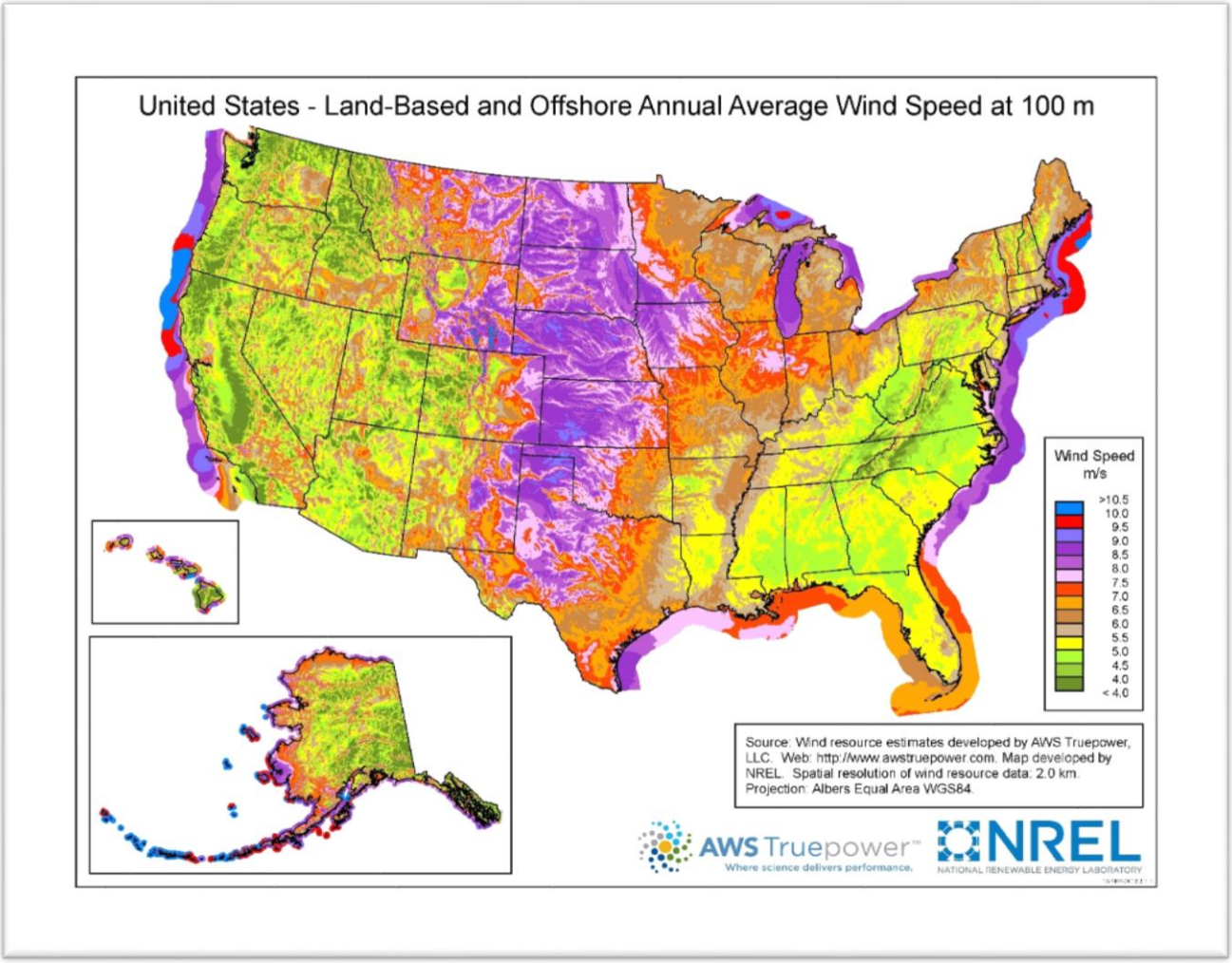

FIGURE 3: UNITED STATES WIND SPEEDS BY STATE

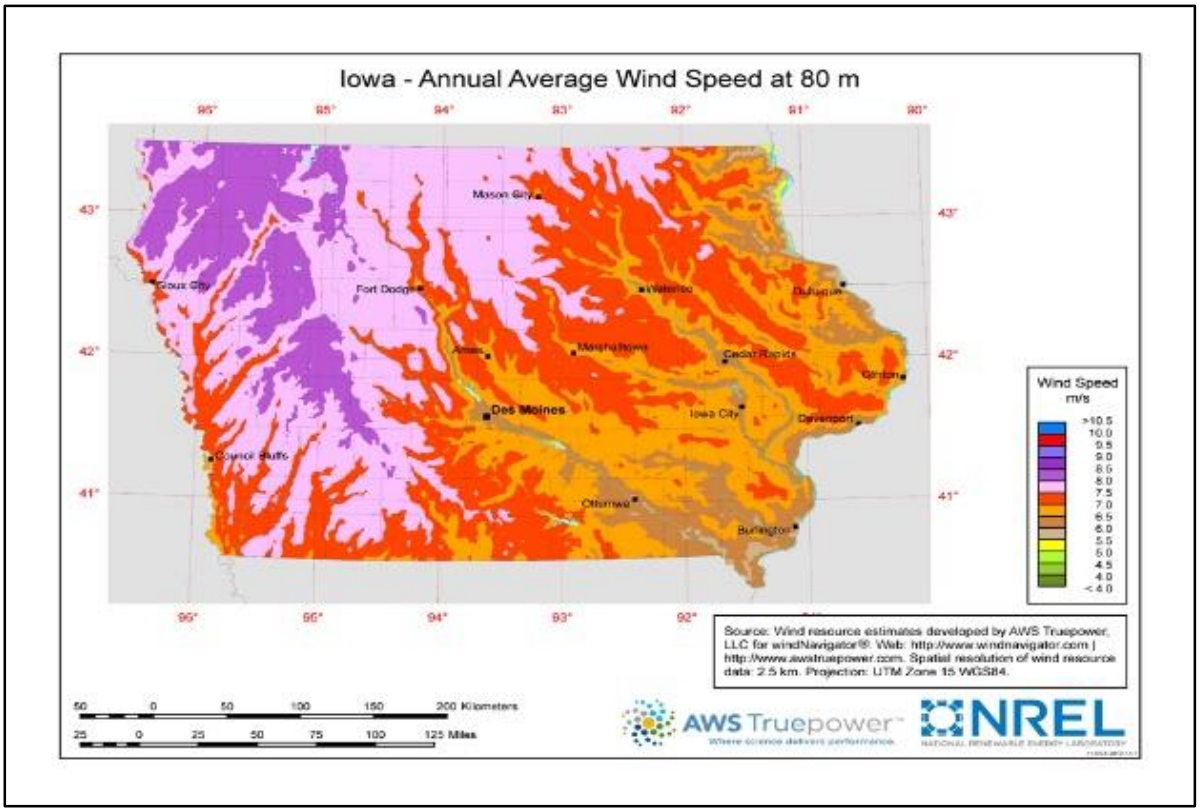

FIGURE 4: IOWA MAP WITH WIND SPEEDS AT 80 M

MidAmerican Energy leads Iowa in wind energy installlation and is recognized nationally for its substantial investment in wind industry. When all of MidAmerican Energy's wind projects are completed, approximately 3,500 or over 39% of its total owned generation will come from wind.[ix]

FIGURE 5: IOWA WIND FARM AT DUSK

According to National Renewable Energy Lab (NREL), 75% of Iowa is suitable for wind energy development with an estimated total wind resource of 570,000 MW.[x] The following chart illustrates Iowa's untapped wind potential.[xi]

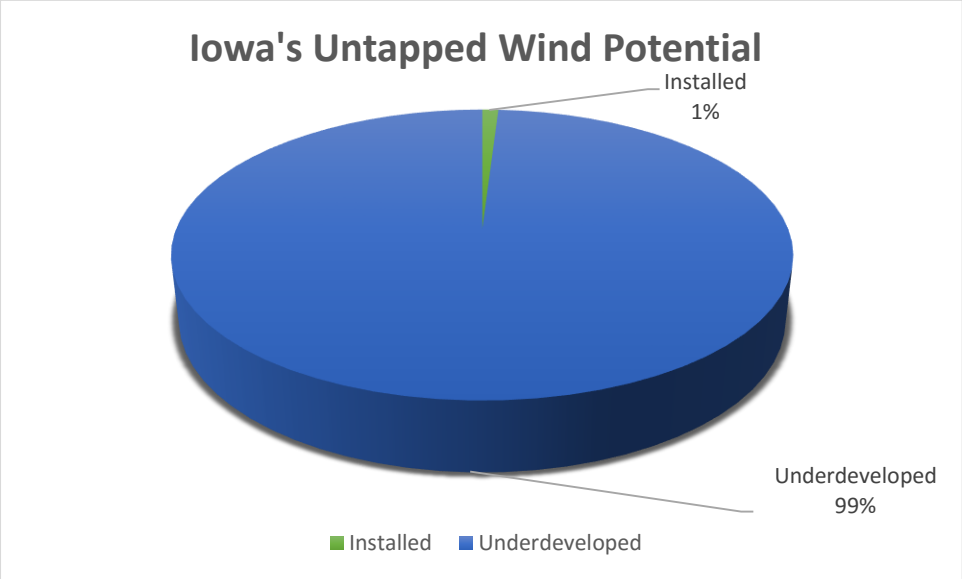

FIGURE 6: IOWA'S UNTAPPED WIND POTENTIAL

Iowa also enjoys strong wind manufacturing presence which has considerably aided the state in leading the nation on wind energy. Companies such as TPI Composites, Siemens, Acciona, Clipper and others have extensive manufacturing bases in Iowa.

Solar

While Iowa is a leader in wind energy, it has the potential to lead in solar as well. Iowa is ranked 16th in the nation for technical solar potential. According to NREL, Iowa has the potential to generate over 7,000,000 gigawatthours (GWh) from solar PV. This amount exceeds the 57,000 GWh of electricity generated by all other sources in Iowa. Just the rooftop solar PV potential in Iowa alone could meet close to 20% of Iowa's annual electric needs.[xii] Iowa currently has anywhere between 1 MW to 3 MW in installed solar PV capacity.[xiii]

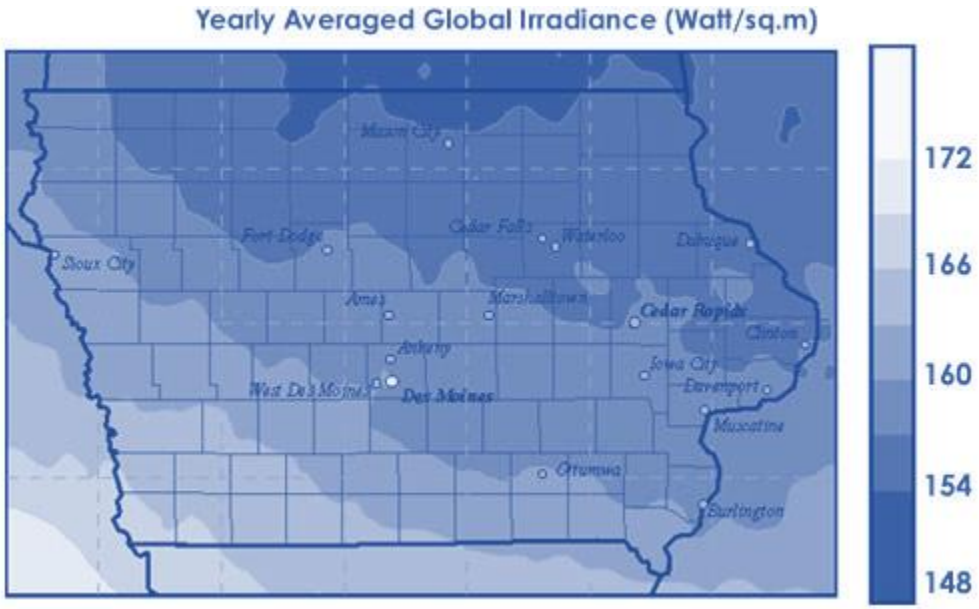

FIGURE 7: YEARLY AVERAGED GLOBAL IRRADIANCE

Solar PV helps meet the peak load demand during hot summer days. This is when the electricity demand is highest and the electric grid is most stressed which results in price hikes. Wind, on the other hand, provides energy during winter and nights. Solar PV and wind complement each other as wind generates power during nights and winter months and solar generates power during day time and summer. Solar also holds significant promise in creating local jobs as workers need to be locally present. According to the Iowa Environmental Council, installation of 300 MW of solar PV in Iowa over a five year period would result in approximately 2,500 jobs each of those five years.[xiv] A recent report issued by The Solar Foundation currently shows approximately 900 solar workers in Iowa.[xv]

Natural Gas/Biogas

Natural gas is the second largest energy source consumed in Iowa even though Iowa does not produce any of the natural gas. Most of the natural gas used in Iowa and transported from Iowa to other states comes from Canada by pipelines through Minnesota and also from the southern states of Texas, Oklahoma, Louisiana, and Kansas. Iowa ships 85% of the natural gas entering the state to other states, primarily to Illinois.[xvi] Natural gas is used primarily in the industrial and the residential sector for heating homes in the winter.

Iowa also has a large supply of biogas potential which is captured through anaerobic digestion. Biogas has the potential to replace natural gas for heating, electricity, and transportation fuel use. The map below demonstrates the biogas resource nationally. Iowa is ranked 8th in the nation for biogas potential with approximately 70% of it from animal manure.[xvii]

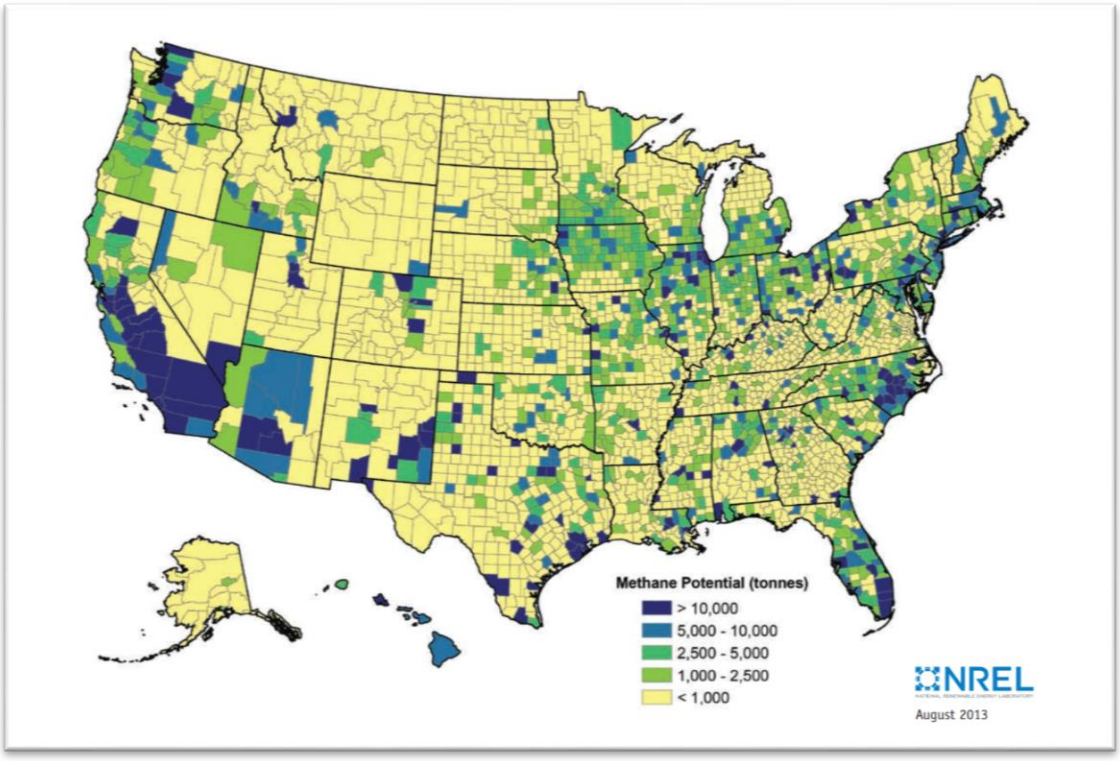

FIGURE 8: US BIOGAS POTENTIAL

While biogas production through Anaerobic Digestion (AD) is a fairly new industry in Iowa, it provides notable benefits besides being an energy fuel and therefore requires special mention. By investing in AD, Iowa's rural communities with wastewater facilities, animal rendering facilities, and farms can easily displace the use of fossil fuels and reduce GHG emissions. AD projects have other environmental benefits as well. AD is described as an example of "depollution" where you take the organic waste and break it down to create "pure" products.[xviii] Other benefits include elimination of odor, reduction in methane, carbon dioxide, and ammonia emissions, capturing of nutrients for reuse which results in decreased use of inorganic fertilizers and protection of groundwater and surface water resources.

Communities in Iowa are increasingly becoming aware of the risks imposed on the groundwater and water resources due to nitrate run-offs and AD is a great solution to address these concerns. Since fertilizer from biogas have bulk and fiber, they are much better at holding the soil and reducing the run-off that happens with the use of chemically manufactured fertilizers. Bio-fertilizers have significant anti-erosion properties. Additionally, use of bio-fertilizers also tend to grow crops that are larger, healthier, insect and disease resistant.[xix]

From an economic development perspective, AD projects and generation of biogas can create a whole new industry, just like ethanol and biodiesel industries. Projects that are completed and are operational demonstrate the economic value of AD projects that range from supplemental income, reduction in costs to dispose organic waste and turn waste liabilities into new profit centers. AD projects at facilities such as wastewater, animal rendering and industrial

manufacturing can significantly reduce operating and energy costs, and water consumption. Moreover, a local biogas industry would allow domestic production of fuels and would keep Iowa dollars in Iowa, something that should be a goal for all economic development proponents. Lastly, local biogas projects will also create jobs and improve resilience of wastewater facilities.

Nuclear

Opinions on nuclear energy vary and bring to the surface strong arguments from its supporters and opponents. Nuclear energy currently provides 20% of the US electricity. In Iowa, its lone nuclear facility Duane Arnold generates more than 8% of the state's electricity. Additionally, it employs 600 Iowans with an annual payroll of $85 million. Setting the issues of nuclear waste aside, nuclear energy does have the lowest impact on greenhouse gas emissions compared to all other energy sources. Yet, even though nuclear energy produces no greenhouse gases, the American public, including Iowans, are generally skeptical of the nuclear energy due to challenges related to the safe storage of spent fuel as well as the high up-front cost. The Japan Fukushima Daiichi nuclear disaster further exacerbated negative public views.

Combined Heat and Power

Often an underplayed technology, Combined Heat and Power is not only clean but also results in significant energy and cost savings. Currently, there are 34 CHP sites in Iowa representing a total installed capacity of 590 MW with the largest CHP site at Archer Daniels Midland (ADM) plant in Clinton (187 MW). However, Iowa is far from realizing its full potential for CHP of 1,675 MW.[xx] Both industrial and commercial sectors are excellent to explore CHP. The figure below shows the significant efficiencies that can be gained through a CHP system.

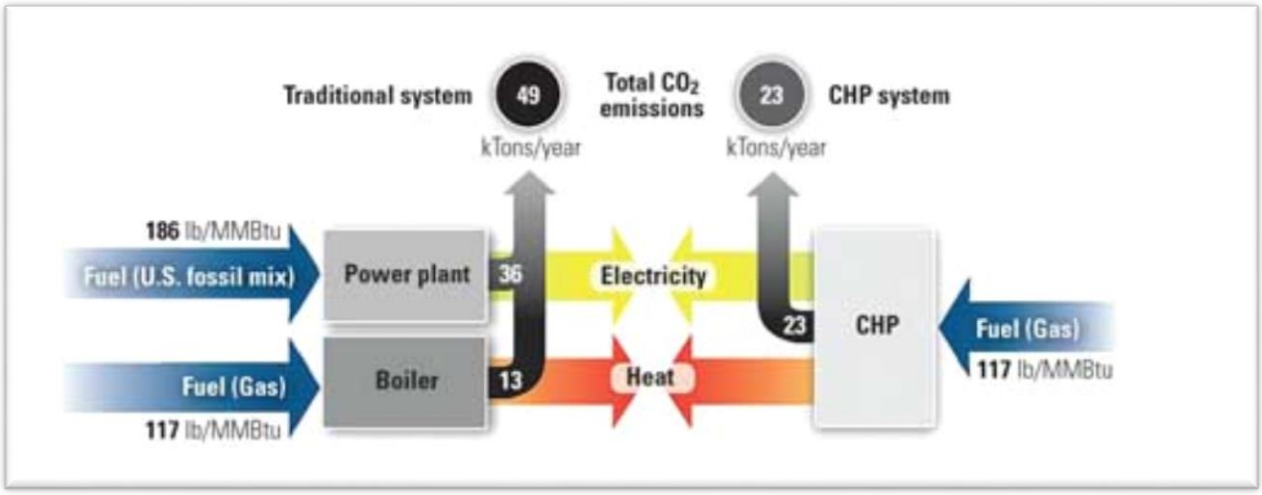

FIGURE 9: CHP EFFICIENCY COMPARED TO A TRADITIONAL SYSTEM

Apart from the efficiencies gained and the cost savings, CHP significantly improves resiliency of critical infrastructure such as hospitals. A case in point is Hurricane Sandy where a small number of facilities, residential buildings, hospitals, universities, and public service facilities, were able

to keep power, heat, and critical equipment functioning via CHP systems when 8.5 million customers lost power.[xxi] CHP provides a hedge against unstable energy prices as the end user is able to supply its own power during times of high electricity prices.

According to many utility policy reviews, standby rates and lack of incentives are cited as big barriers preventing the implementation of new CHP projects.

Energy Efficiency

Iowa utilities have offered energy efficiency programs over many years. However, environmental and consumer advocates believe Iowa should set stringent standards for energy efficiency programs and strengthen its program offerings. Energy efficiency is the cheapest way to save on electricity costs and also offers the quickest payback. Iowa's current utility energy savings target is 1.2% and according to some sources can easily be increased it to 1.5%. In 2014, Alliant Energy came under fire from environmental organizations for reducing its energy efficiency targets when studies showed that they could have set a cost-effective target double of what they opted for. The study conducted by Cadmus Group and commissioned by Iowa utilities, including Alliant Energy showed that Alliant Energy could save over 2% of annual retail electric sales through cost-effective efficiency methods.

Transportation

There are two areas under the transportation sector that are worth noting. One, is the production and consumption of biofuels and the other is promotion of green transportation alternatives. Iowa has supported a number of cellulosic based ethanol plants but the numbers are scarce due to complexities around the technology and high costs of production. These factors have inhibited cellulosic ethanol industry's ability to meet the requirements of the federal renewable fuels standard. Because of this, Environmental Protection Agency's (EPA) new proposed caps on total renewable fuel target and the advanced biofuels blending targets are reduced significantly. Specifically, for cellulosic ethanol, this translates to a 99% drop, from 1.75 billion gallons annually to 17 million gallons annually. Agricultural economy in Iowa as well as other Midwestern states are heavily dependent on the biofuels market which adds complexity and uncertainty to the direction the industry should take.

On the green transportation side, Iowa is a car-dependent state. The Iowa Department of Transportation's State Transit Assistance Program devotes 4% of the fees collected for new registration on sales of motor vehicle and accessory equipment to support public transportation. However, Iowa does not have any policy or standard for tailpipe emissions, vehicles miles traveled, or incentives for high efficiency vehicles. Under ACEEE's Energy Efficiency Scorecard, Iowa receives a score of 2 out of 9 for its transportation programs. Nonetheless, individual cities in Iowa have made tremendous strides in green transportation options. For example, Des Moines, Iowa City, and Dubuque have adopted programs and policies to promote bicycling. Similarly, quad cities continue to focus on improving walking, biking, and mass transit options. While all these efforts are in the right direction, Iowa will benefit from a

statewide strategic plan to reduce carbon and other greenhouse gas emissions from cars and other vehicles and by establishing standards and/or incentivizing the use of alternative transportation methods.

Public Perceptions and Preferences

Iowans have made clear their preferences for sound energy choices. A statewide voter survey conducted in 2014 by a bipartisan research team of Fairbank, Maslin, Maullin, Metz & Associates and Public Opinion Strategies found overwhelming support for energy efficiency and clean energy choices.[xxii] On the question of whether the voters support increased use of energy efficiency and wind, over 70% of respondents indicated "strongly support" and over 60% of voters strongly support solar.

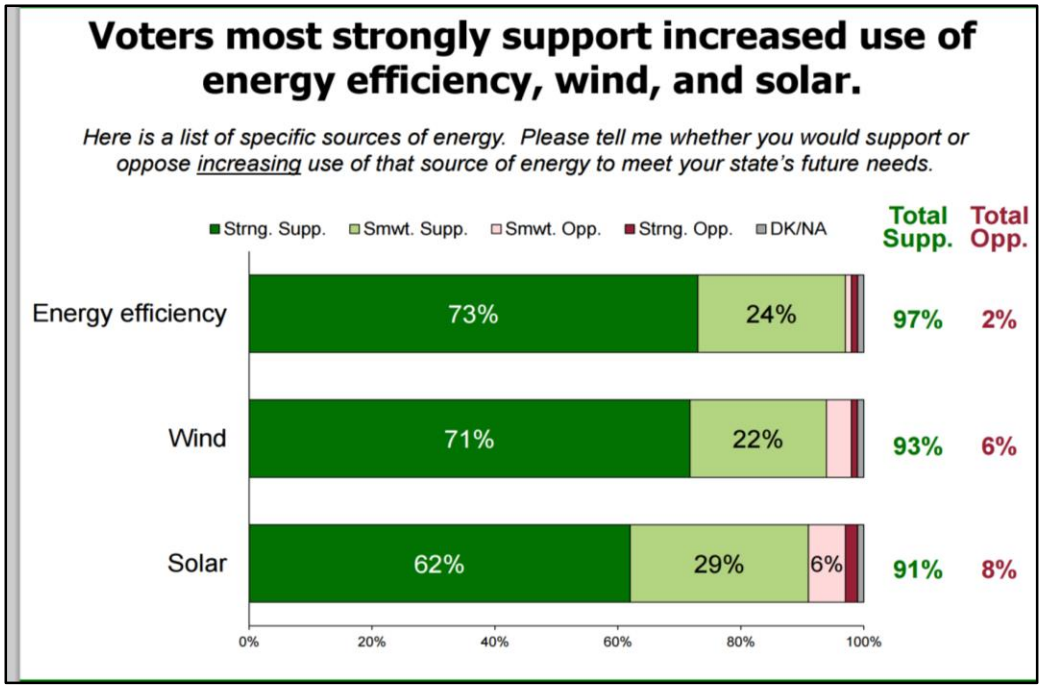

FIGURE 10: BIPARTISAN SURVEY ON ENERGY PREFERENCES

Moreover, energy efficiency is supported along party lines, gender, age group, and among all income class.

In addition to the preference for clean energy choices, Iowa has an imperative to offer these choices. Significant number of families struggle to pay heating bills in the winter. In 2014 winter, 16,000 homes did not have heat during the beginning of the winter season. Data also shows that number of Iowans with energy bills past due did not decrease from 2013.[xxiii]

Furthermore, low-income households disproportionally spend a significant portion of their income on energy costs. Low-income households in the Midwest spend on average 13% of their entire incomes on home energy costs, compared to 3% for non-low-income households.[xxiv]

While there are federal programs such as Low-Income Home Energy Assistance Program (LIHEAP), they only go so far. One study shows that the annual energy bill during 2008 was $2,066 while the average 2008 LIHEAP payment was only $390.11.[xxv] Cleaner energy choices, especially rooftop solar PV offer a way out for low-income individuals to become energy independent and invest their incomes elsewhere that better their lives.

Economic Growth Opportunities

Various studies have shown repeatedly the vast economic growth potential for renewable energy industry in Iowa. Iowa is already experiencing these projections. According to Advanced Energy Economy (AEE), Iowa currently boasts 22,000+ clean energy jobs. AEE's survey also projects a 6% job growth in 2015. The survey shows that out of the 1,427 advanced energy establishments in Iowa, 62% list "building energy efficiency" as their primary form of engagements with a total employment of 10,888 workers. Out of this, 6,000-7,000 jobs are in the wind industry. The Solar Foundation's 2015 solar jobs census report also shows that Iowa currently has 900 solar workers and will experience 10% growth in solar jobs in 2016. [xxvi]

According to a study by the Union of Concerned Scientists, in 2012, Iowa sent $590 million out of state to import 23 million tons of coal, primarily from Wyoming. On a per capita basis, this amounts to $193 per person.[xxvii] Due to the nature of the clean energy industry, all jobs are local. For example, renewable energy industry is labor intensive so they create more jobs per dollar invested than conventional electricity generation technologies. Additionally, renewable energy industry utilizes local resources which keeps most of the energy dollars local.[xxviii]

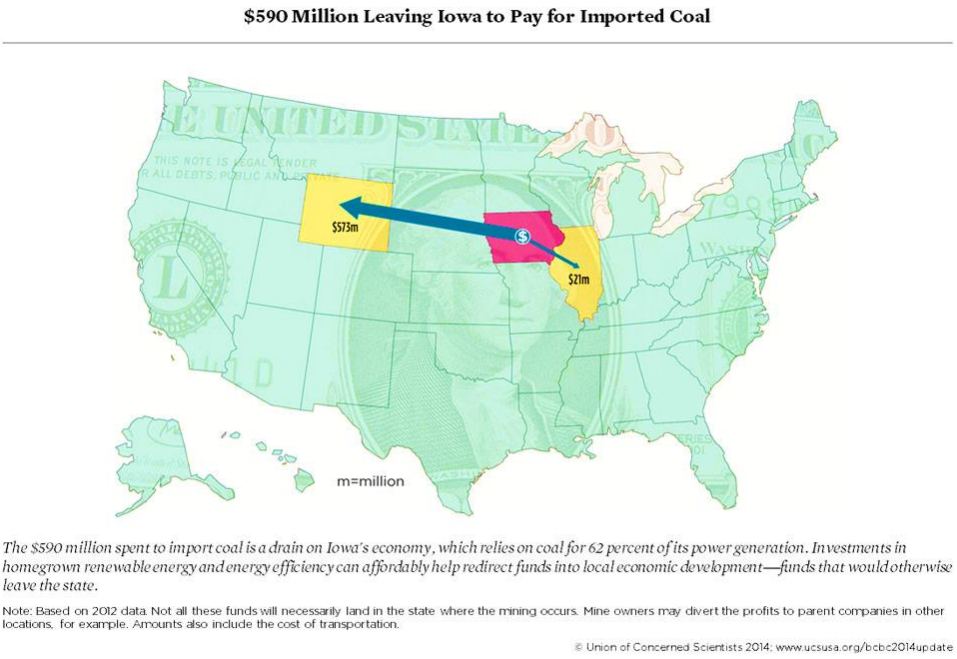

FIGURE 11: DOLLARS DEPARTING IOWA FOR ENERGY FUEL PURCHASE

The potential to keep these dollars in Iowa through energy efficiency and renewable energy is immense. Moreover, energy dollars invested locally create a multiplier effect which increases the economic value created through direct, indirect, and induced benefits. Iowa currently spends $29/person on energy efficiency programs compared to Massachusetts which spends $78/person[xxix] and is ranked first in ACEEE's Energy Efficiency Scorecard. Iowa is ranked 5th nationally for per capita energy consumption. Therefore, any opportunities to improve our energy intensity should be realized.

Climate Change Considerations

Apart from the economic arguments to expand Iowa's clean energy sector, the climate change argument is increasingly more urgent and requires immediate attention. Natural disasters events and the subsequent economic loss as a result of climate change are well documented. According to Iowa Climate Change Impacts Committee's Report to the Governor and the Iowa General Assembly[xxx], Iowa is already experiencing the climate change impacts such as:

- Increased frequency of precipitation extremes that lead to flooding
- Increase in long-term winter temperatures
- Increase in humidity levels, especially in the summer,
- Plants are leafing out and flowering sooner.
- Birds are arriving earlier in the spring.
- Increase in heart and lung problems from increased air pollutants of ozone and fine particles enhanced by higher temperatures.
- Increase in infectious diseases transmitted by insects that require a warmer, wetter climate.

The US and Iowa are also witnessing a surge and intensity of natural disasters. Iowa's major cities such as Des Moines, Cedar Rapids, Iowa City, and Ames have all suffered multi-million to multi-billion dollar losses due to floods since 1993.[xxxi] The Cedar Rapids floods single-handedly put the loss at $10 billion.[xxxii] While these cities have recovered, the ability and the resource capacity to response to these disasters will be stressed as the frequency of these events increase. Nationally, we have seen natural disasters such as Hurricanes Katrina and Sandy costing the states billions of dollars in economic losses and recovery.

The report, *Risky Business*, concludes that the American economy faces multiple and significant risks from climate change. The report also notes that rising heat resulting from increased greenhouse gas emissions is likely to affect the Midwest region through higher heat-related mortality, increased electricity demand and energy costs, and declines in labor productivity. Energy Costs are likely to increase by 29% by the end of the century, posing a huge risk to the manufacturing section having to spend more energy and dollars in cooling. Midwest, home to about one-third of all US manufacturing operations and with industry that are energy-intensive will be hurt the most.

Additionally the agricultural sector is likely to suffer yield losses and economic damages as temperatures rise.[xxxiii] The following figure gives a visual on what the losses would look like over time.

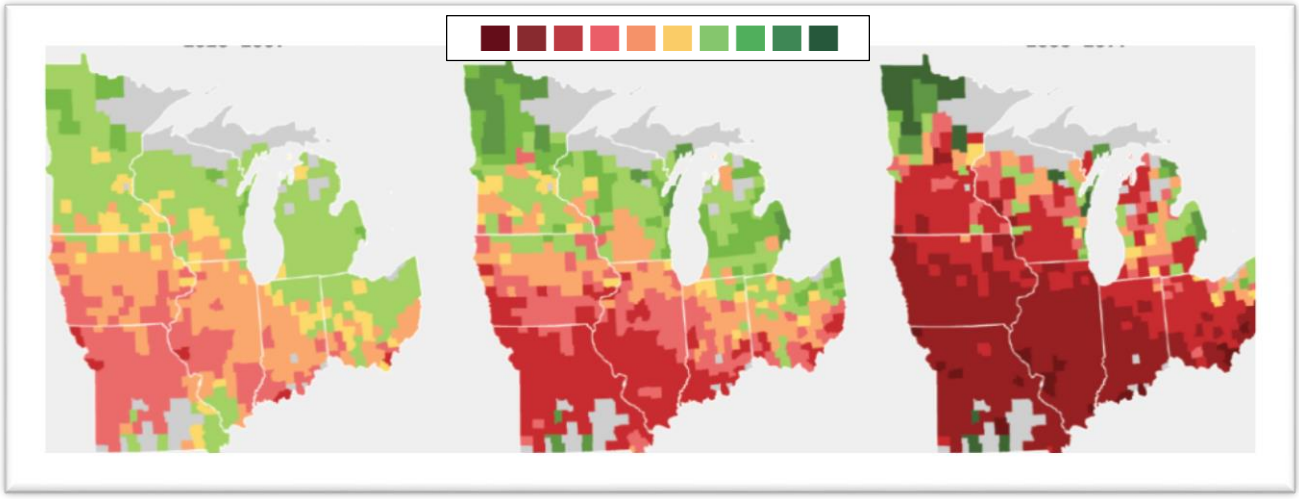

FIGURE 12: MEDIAN PERCENT CHANGE IN YIELD OF CORN, SOYBEANS, AND WHEAT RELATIVE TO CURRENT PRODUCTION WITHOUT SIGNIFICANT ADAPTATION[xxxiv]

The transportation sector is also facing costly climate change related impacts. Extreme weather events such as flooding damage roads, bridges, and rail systems, requiring millions of dollars in repairs. Likewise, droughts such as Iowa drought of 2012 disturbed waterways which are essential for transporting barges. According to the American Waterways Operators (AWO), in December and January alone of 2013-2014, more than $7 billion worth of goods were at risk of not reaching their destination. Tom Allegretti, President and CEO of American Waterways Operations, says, "The implications of the drought conditions and low-water levels are a one-two punch for the economy, impacting both the agricultural community and one of the major modes of transporting agricultural and other essential products. The nation's waterways truly move the building blocks of what we as consumers use every day."[xxxv]

Federal Regulations

While some view increased regulations a federal overreach, the reality is that they are here. Moreover, a majority of Americans support regulations that are intended at safeguarding the environment and mitigating the impacts of climate change. A poll undertaken by Washington Post-ABC News poll shows that 70% of Americans say that the federal government should require limits to reduce greenhouse gases from existing power plants and an identical 70% support mandates on states to limit the amount of greenhouse gas emissions within their borders.

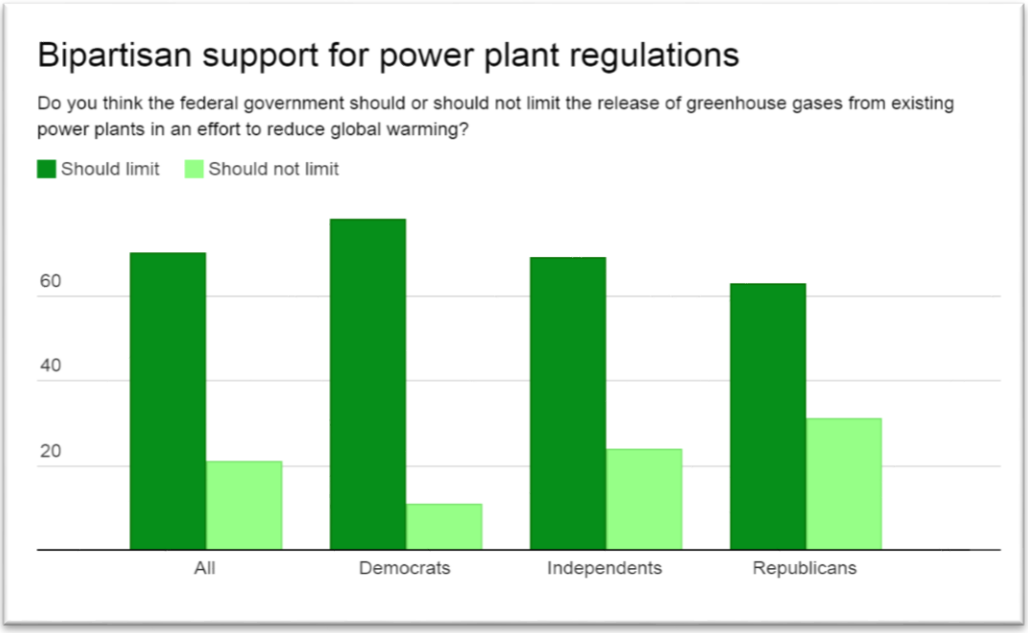

FIGURE 13: SUPPORT FOR POWER PLANT REGULATIONS

Notably, 69% of the respondents in coal-burning states support government's placement of limits on greenhouse gas emissions.

Below is a run-down of the key environmental regulations that have been implemented in the near past or will be put in place fairly soon.

- *Mercury and Air-Toxic Standards (MATS):* The Environmental Protection Agency finalized the MATS rules in 2011 to reduce mercury and other air toxic pollutions from coal and oil-fired power plants. These power plants are currently the biggest sources of emissions. Other sectors, namely medical waste incinerators, and municipal waste combustors that were a leading cause of mercury emissions have significantly reduced emissions by more than 95%. 40% of the current energy generating units (EGUs) do not have advanced pollution control equipment despite wide-spread and cost-effective availability of such technologies. These rules are expected to reduce 90% of the mercury emitted in the air, 88% of acid gas emissions, and 41% of sulfur dioxide emissions from power plants. EPA provided at least four years to power plants to comply with these regulations.

- *Clean Power Plan:* Currently, US lacks any sort of limit on carbon emissions. The power sector is the largest contributor of carbon pollution in the US amounting to roughly one-third of all domestic greenhouse gas emissions.[xxxvi] The EPA's Clean Power Plan intends to reduce carbon pollution by 32% from the 2005 levels by 2030. EPA estimates billions of dollars in public health and climate benefits estimated at $55 billion to $93 billion in 2030. EPA issued the final rules in August 2015 and has offered states a flexible approach to comply with the standards.

Specifically, the Plan offers three building blocks that states can use as compliance strategies. These include:

- Power Plant heat rate improvements
- Switching to natural gas as the primary fuel source
- Switching to renewable energy sources

While energy efficiency was originally listed as one of the building blocks, EPA removed it from its final rules even though it will be a significant compliance strategy for multiple states.

Iowa's target for emissions reduction is 12% from the 2012 baseline. Iowa's emission rate from the baseline year of 2012 is 2,195 lbs/MWh and the 2030 goal is 1,283 lbs/MWh. States have the option to convert their rate-based goal to an equivalent mass-based goal which means Iowa will have to reduce 25,018,136 metric tons of CO_2.

Figure 14 gives an overview of Iowa's CO_2 emissions by category. As it shows, the power sector, transportation sector, and the industrial (fuel use) sector are the biggest emitters of CO_2 in Iowa. Figure 15 lists out the affected sites in Iowa. [xxxvii]

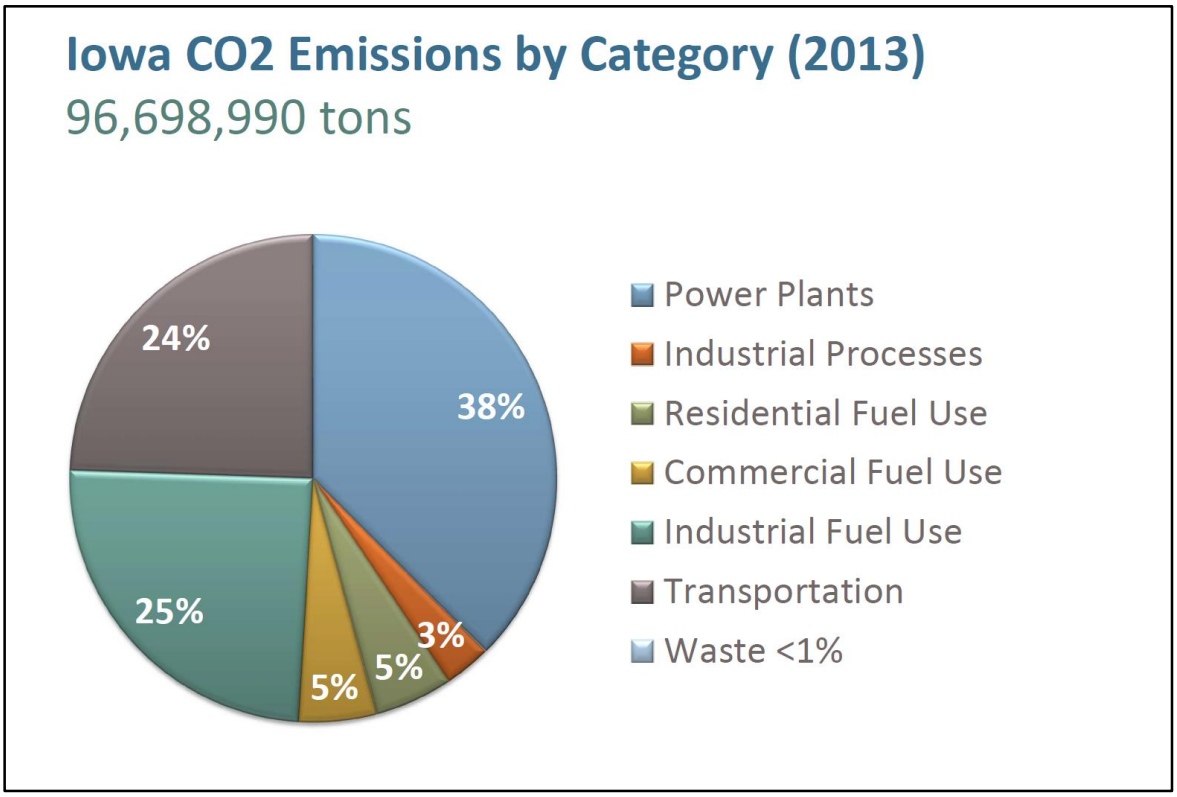

FIGURE 14: IOWA CO2 EMISSIONS BY CATEGORY

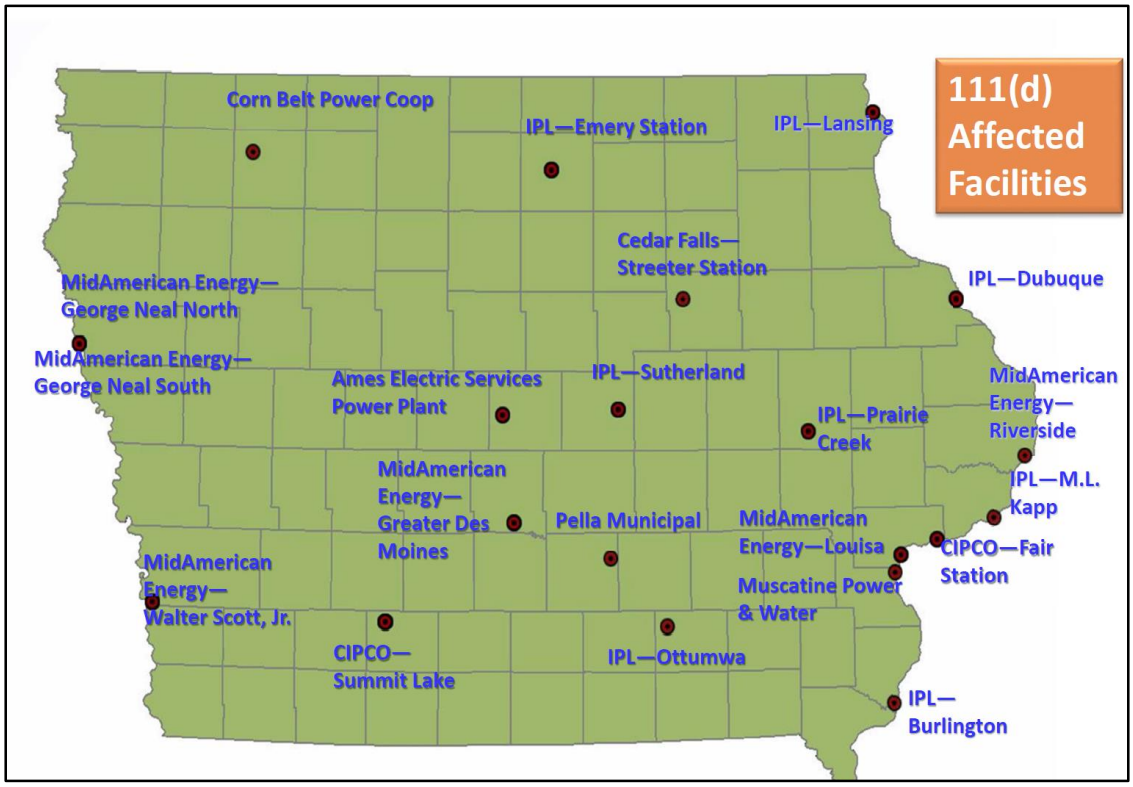

FIGURE 15: AFFECTED SITES IN IOWA

In 2016, the US Supreme Court voted 5-4 to stay the implementation of the Clean Power Plan, thus making the implementation of CPP uncertain. However, many clean energy leaders believe that decision will not slow down the clean energy trend. According to the Federal Energy Regulatory Commission (FERC), nearly two-thirds of the US generating capacity in 2015 was from renewable sources.[xxxviii]

Methane regulations: EPA is also planning to regulate methane emissions from oil and gas sector. Methane is one of the greenhouse gases which has 20 times greater warming effect on the climate than CO_2. The rules, proposed in the summer of 2015, will be completed by 2016 will cut methane emissions by 40% to 45% of the next ten years from 2012 levels and will apply to new or modified sites. EPA is relying on voluntary measures for existing oil and gas operations.

Decoupling of Energy and Economic Growth

As the urgency around climate change increases globally, national and state leaders are faced with immense pressure from their constituents to undertake steps to mitigate impacts of climate change.

More importantly, the economy is witnessing a new phenomenon where the economic growth is showing signs of decoupling from energy consumption. Traditionally, the US economy and energy consumption and the subsequent greenhouse gas emissions have shown direct

relationship where one has led to the growth of another and vice versa. However, data now suggests that this relationship might be splitting partly due to energy efficiency and addition of renewable energy in the energy mix. The US Department of Energy data shows that the US energy consumption is decelerating which is in contrast to a growing economy and a growing population.

Energy efficiency and renewable energy is also resulting in a shift from a high-carbon economy to a low-carbon economy. With this comes a risk of "stranded assets". Due to the growing risks of climate change and increased pressures and demands for a carbon-free economy, investments in fossil fuel companies is increasingly becoming a dicey proposition and a financial risk. This has resulted in divestments from fossil fuel companies. Divestment minimizes the risks for the investors and at the same time gets us closer to a carbon-free economy.

The next section presents energy policy and programmatic recommendations that Iowa, and by large, other states should adopt. These recommendations are low-cost, effective, and most importantly, create jobs. In addition to these benefits, they get us closer to a carbon-free economy.

Implications of a Carbon Free Economy

Numerous indicators point to a growing demand for a carbon-free economy. Simply put, a low-carbon economy (LCE) is an economy that is based on low-carbon power sources with a minimal output of greenhouse gas (GHG) emissions. Recent examples include G7's agreement on cutting greenhouse gases by phasing out the use of fossil fuels by the end of century. [xxxix] In the US alone, states are taking bold steps to reach a low-carbon economy such as Hawaii with its 100% renewable energy target by 2045[xl] and California with its current passage of SB 350 that would require the state to get 50% of its electricity from renewable sources by 2030.[xli] Iowa is already on an upward trajectory towards the low-carbon economy with over 28% of its energy coming from wind alone.

To fully reach a carbon free economy, it may require two things. One, different jurisdictions, whether states or countries, set aggressive standards for renewable energy sources, impose a carbon tax or implement a cap and trade program. In 2009, the US House of Representatives approved a bi-partisan cap and trade bill to establish caps on industrial carbon emissions and create a mechanism for utilities and businesses to trade credits to meet targets. However, this did not move forward. Popular think tank groups such as the Tax Policy Center at the Urban Institute and Brookings Institute are beginning to promote a carbon tax as a critical piece of the comprehensive tax reform.[xlii] The support for carbon tax is also coming from an unusual sector – the oil industry. In May 2015, six oil companies which included BP and Royal Dutch Shell penned a letter to the United Nations (UN) lobbying for a price on carbon as a key element of any inter-governmental action to address climate change.[xliii]

While implementing any carbon policies is complex and a colossal task, states such as Iowa should work towards strengthening locally-designed energy efficiency and clean energy programs and policies to avoid price shocks or wide disturbances that may result.

Recommendations

While this paper discussed a number of factors that are critical in the energy and climate debate, the following policy recommendations are intended to spur dialogues around our energy policies with a goal of effectively utilizing Iowa's abundant natural resources to reduce energy costs and create jobs.

Strengthen Renewable Portfolio Standard with Carve-outs for Solar and CHP

Iowa has shown that a combination of strong leadership and favorable regulatory structure can result in successful compliance with an RPS standard. Iowa has long surpassed its 105 MW standard that was created in 1983. Multiple analysis shows that Iowa still has significant capacity to be tapped in wind, solar, and CHP. The 2011 Iowa Energy Independence Plan recommended a new goal of 10,000 MW of wind by 2025. As our past successes have shown, this goal can effortlessly be reached if simultaneous developments are made to expand the transmission line capacity.

Iowa should take the opportunity to revise its RPS by creating carve-outs for solar and CHP. Iowa's current solar installed capacity stands at approximately 25 MW which is much lower than its potential capacity.[xliv] A bill was introduced in 2013 to create a solar carve-out that would have created a standard of 115 MW by 2018 and 300 MW in five years from the start date.

Increasing Iowa's RPS will aid in complying with the Clean Power Plan 111(d) regulations. According to the Union of Concerned Scientists, wind emits only 0.02 to 0.04 pounds of CO2E/kwh and solar emits anywhere between 0.07 CO2/Kwh. These numbers are a tremendous improvement over coal which emits between 1.4 and 3.6 pounds of CO2E/kwh and natural gas which emits between 0.6 and 2 pounds of CO2E/kwh.[xlv] Moreover, the unquantifiable benefits of reducing these emissions are endless. Clean energy choices reduce incidents of breathing problems, neurological damage, heart attacks, cancer and also reduce premature mortality and overall healthcare costs.[xlvi] The economic impact of these impacts range between $361.7 billion to $ 886.5 billion.

Lastly, switching to wind and solar also reduces the stress on our water resources. Water scarcity both globally and nationally have pointed to steps we need to take to safeguard this resource as well. The figure below depicts the water impact of electricity produced from various sources.[xlvii] Clearly, solar, wind, and energy efficiency are the winners here.

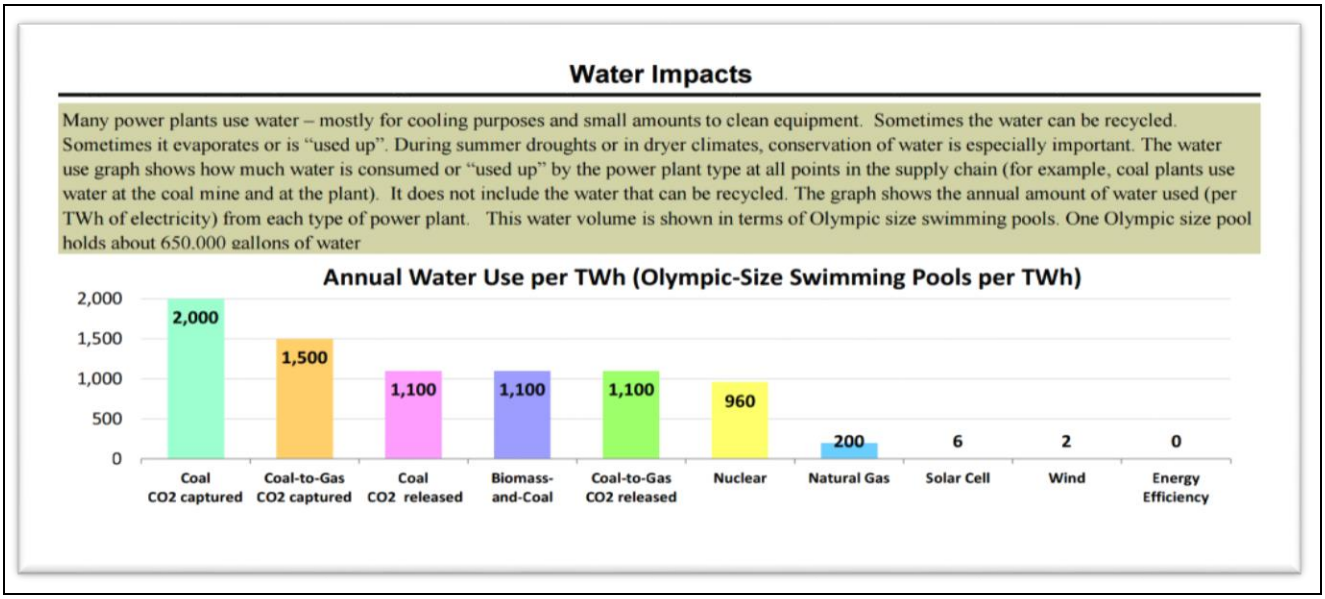

FIGURE 16: WATER IMPACT OF VARIOUS ENERGY SOURCES

Moreover, the cost of clean energy technology has come down considerably. A report by Lazard finds that the unsubsidized cost of solar and wind has reached cost parity with conventional fossil fuels in many parts of the US. Alliant Energy recently issued a Request for Proposal (RFP) for up to 200 MW of in-state wind energy.

The biggest obstacle regarding renewable energy choices is that they are intermittent and therefore, grid operators need to maintain full generation capacity from "baseload" plants powered by coal and/or natural gas. In a study conducted by Dr. Mark Diesendorf, he points out that the biggest barrier to integrating renewable energy sources into the grid is the "operation inflexibility of base-load power stations." Texas provides a great case-example where they continue to meet significant percentage of load with wind capacity. By utilizing a new modeling tool that provides real-time conditions, grid operators are able to match generation with demand.[xlviii] According to NREL, one-third of the US power could be generated from renewables if other grid operators adopted similar tools.[xlix]

Strengthen Current Policy Framework to Promote Clean Energy Technologies

In addition to revising the RPS, Iowa decision-makers should ease policy and regulatory structure to allow growth of clean energy. Certain areas to consider include net-metering rules, interconnection standards, and distributed generation power ownership models. Iowa has a well-defined net-metering and interconnection standards but it only applies to investor-owned utilities (IOUs). While non-IOUs can certainly adopt these standards, there is no prerogative to do so. Requiring all utilities in Iowa to adopt the existing net-metering and interconnection standards

will eliminate system wide inefficiencies and create a seamless implementation process for vendors and installers who provide services to Iowa consumers. On the interconnection side, Iowa should revise its interconnection standard and make it consistent with Federal Energy Regulatory Council (FERC's) updated interconnection rules which were adopted in 2013.[l] Other policies such as "virtual net-metering" should be enabled to allow consumers access to clean energy who may lack suitable land space, rooftop, or the means to individually own a system, particularly as a strategy for low-income households.

Additionally, Iowa should objectively assess fair compensation for solar PV. An independent study should be undertaken to truly understand the costs and benefits of clean energy and design rate models that equitably compensate owners of distributed generation. On the CHP side, it is critical that barriers such as standby charges are not exorbitant since these dissuade entities from pursuing CHP technologies. Similarly, CHP should be categorized as a renewable energy technology with the same level of policy benefits such as net-metering that wind and solar benefit from.

Promote Energy Efficiency and Conservation Programs

Iowa utilities generally do a good job of offering rebates for energy efficiency programs. Despite these efforts, there is still room for improvement on energy efficiency in Iowa's public buildings. The State of Iowa should take the lead to reduce its own energy consumption. Efforts under the Iowa Department of Administrative Services (DAS) have significantly improved energy efficiency of the Capitol Complex. However, this leaves a significant portion of the state buildings untouched. Further assessment of Iowa's public building stock demonstrates the vast potential for energy efficiency in these buildings. According to the Iowa Public Buildings Benchmarking Project, it can be assumed that Iowa's public building stock ranges from 6,000 to 8,000. This does not include the commercial and the industrial buildings. As noted by the US EPA Energy Star website, there are 255 buildings in Iowa that are Energy Star labeled buildings.[li] While Energy Star is certainly not the only standard to measure a building's energy performance, it does provide some light on the miniscule number of Iowa's buildings that have aggressively addressed a building's energy footprint.

These are significant energy savings potential in the state. In order to reach this potential, a number of low-cost or no-cost strategies can be applied as detailed below.

1. Promote Energy Efficiency at the State Level and Lead by Example: With the work already undergoing by DAS and IEDA, the state should require all of its buildings to set energy efficiency and conservation goals and measure progress periodically. In order to begin this initiative, the state of Iowa should form a State Buildings Energy Council and require participation by all state agencies to set performance goals, objectives, and action plans. A portion of each agency's budget should be set aside especially for energy efficiency and clean energy improvements. This can either be managed by DAS or by the state agencies themselves. This model can then be replicated at local governments.

2. Mandate Participation of Iowa's buildings into the Iowa Public Buildings Benchmarking Program: The State of Iowa should require all public buildings to participate in the

benchmarking program. The program, offered by IEDA and the utilities is a low-cost program which provides valuable data that can be used by building managers to make sound energy efficiency decisions. Currently, only 2,000 public buildings are benchmarked in this tool which leaves a lot of room for other buildings to participate. The Benchmarking platform could then be extended to benchmark other buildings in the commercial and industrial sector.

3. Strengthen Iowa's Energy Financing Programs: Iowa's public entities have benefitted from low-interest rate funding from the Iowa Energy Bank for a number of years. Unfortunately, the program does not have any additional funds to lend out leaving Iowa's institutions with no incentives to undertake energy projects. Replenishing this fund will provide the necessary capital to drive energy efficiency projects. Loans can be paid back in a significant short period of time and since public sector institutions are by-large credit-worthy, the risk of loan default is fairly low.

   Iowa should also tie energy efficiency and/or clean energy requirements with its economic incentives package. In addition to job creation and retention, energy efficiency/clean energy could be established as one of the criteria. Existing and prospective enterprises are widely aware of the benefits of energy efficiency and clean energy investments and therefore, this should pose little to no challenges in implementation.

4. Enact Buildings Energy Labeling Initiative at the Municipality Level: Local governments should implement an energy labeling initiative for commercial buildings, mixed-use, and multi-family residential buildings. Free tools such as EPA's Energy Star could be utilized. According to a study undertaken by EPA, energy labeling of buildings result in significant benefits that range from reduced energy use. ENERGY STAR labeled buildings are one-third more energy efficient than average US buildings and have utility bills that are 35% lower than the average building. Other benefits include higher occupancy rates, occupant comfort, and increased asset value trend.[lii] A number of US cities have already enacted energy labeling and Iowa cities should implement similar policies.

Strengthen Building Codes and Compliance

In recent years, Iowa has taken the lead in adopting latest building energy codes. Continuous updating of building energy codes is the surest way to ensure that buildings are designed in the most energy-efficient manner as possible, negating the need for costly retrofits. According to the US Department of Energy, energy cost savings resulting from building energy codes are estimated at about $5 billion annually as of 2012 and 36 million tons of carbon savings as of 2012.[liii]

Moreover, the State of Iowa should provide additional funding to the Iowa Department of Public Safety (DPS) for compliance, education, and monitoring purposes. Adoption of any codes is of little value if it is not followed by monitoring and compliance.

Establish Clean Energy Investment Fund

In order to stay ahead in the clean energy space, Iowa needs to promote innovation and entrepreneurship. This can happen in two ways. One, significant awareness, education, and resources should be provided on clean energy innovation either through the Iowa Innovation Corporation or at the academic institutional level. Secondly, there is no funding in the state that is specifically targeted towards clean energy development so the state should inject additional funding for early commercialization specifically in the clean energy space as they did through the Iowa Power Fund.

The Iowa Power Fund established in 2007 was a $100 million initiative introduced by Governor Chet Culver to promote research and development, early stage commercialization, and energy education. While the program certainly leaves a lot of room for improvement, it also demonstrates multiple success stories. The POET Project Liberty, commercial-scale cellulosic ethanol biorefinery to come online was the first in the nation to utilize corn waste as feedstock for ethanol production. The project received $14.75 million from the Iowa Power Fund and leveraged $100 million US DOE funds. Similarly, another project undertaken by Acciona Wind Power North America commercialized the AW-3000, 3 MW wind turbine by utilizing $3 million from the Iowa Power Fund and leveraging approximately $17 million from internal sources and federal funds.

These are just couple of successful examples demonstrating why the Iowa Power Fund was a unique program. It provided state dollars that were leveraged many times over with private and federal funding. This report recommends that a new clean energy investment fund be established that is modeled after the Iowa Power Fund and focuses solely on funding cutting-edge early-stage commercialization projects.

Create a Statewide Public Education Program on Energy Conservation, Efficiency, and Clean Energy

Lastly, the State of Iowa should undertake an education campaign to increase awareness among Iowans on energy efficiency and clean energy. Education on the benefits of energy efficiency can help consumers save significantly on their utility bills. Programs should be targeted especially towards low-income and minority households that often lack the tools and resources to gather information on their own. On the clean energy side, topics such as economics, tax incentives, utility requirement, and installer qualifications should be addressed in layman's terms. Additionally, awareness around the financial, economic, and environmental benefits of clean energy and energy efficiency should be emphasized so that Iowans can make sound decision in supporting policies that work best for Iowa.

Conclusion

Iowa has a unique opportunity to lead the clean energy space to address the insurmountable challenges of climate change. Iowa demonstrated its climate leadership in 2007 when the Iowa Legislature adopted the SF 485 which established the Iowa Climate Change Advisory Council (ICCAC) and directed it to establish a system for reporting and monitoring greenhouse gas emissions and develop scenarios for reductions by 2050.

Iowans have made clear their preferences for energy choices as demonstrated by a statewide voter survey which found that Iowans overwhelming support energy efficiency and clean energy choices.[liv] Moreover, Iowa has both an economic and an environmental case to adopt policies and programs that work for the people and not a handful of special interest groups.

The threats of climate change on public health, economy, environment, and a community's well-being are real and cannot be undermined. Utilizing Iowa's natural resources, whether it is in wind, solar, energy efficiency, or biomass is a natural pathway that Iowa should adopt. While federal or state regulations or mandates may not be a preferred way to get to the clean energy economy for some, it is a necessary step in terms of setting benchmarks and standards. Moreover, Iowans and Americans nationally are demanding clean energy action from their elected officials and their governments. Regardless of the regulations or the ever-changing political environment, the recommendations listed above are good for the state and the economy and most of all for the people of Iowa.

References

[i] "Voter Attitudes Toward Energy Issues in Iowa: Key Findings from a Statewide Voter Survey", 2014, [http://energydistrict.org/images/uploads/2014-Midwestern-Energy-Issues-Survey-IOWA-RELEASE.pdf]

[ii] Climate Change Overview, Iowa Department of Natural Resources [http://www.iowadnr.gov/Environment/ClimateChange.aspx]

[iii] Iowa Profile Data, US Energy Information Administration

[iv] Ibid

[v] Ibid

[vi] "Iowa: An Energy and Economic Analysis", Institute for Energy Research, 2013 [http://instituteforenergyresearch.org/analysis/iowa-an-energy-and-economic-analysis/]

[vii] State and Local Policy Database, American Council for Energy-Efficient Economy, 2015 [http://database.aceee.org/state/iowa]

[viii] American Wind Energy Association

[ix] MidAmerican Energy [http://www.midamericanenergy.com/wind_overview.aspx]

[x] National Renewable Energy Lab

[xi] Turner, Dan and Wind, Thomas, "Iowa's Wind Energy Potential for Addressing 111(d) goals" The Potential for Tapping Iowa's Wind Resource to reduce CO2 Emissions" 2015

[xii] "Real Potential, Ready Today: Solar Energy in Iowa", Iowa Environmental Council, 2014 [http://iaenvironment.org/documents/2014/solarpub/RealPotentialReadyToday_pub_web.pdf]

[xiii] American Council on Renewable Energy (ACORE) and The Open PV Project, National Renewable Energy Lab [http://www.acore.org/files/pdfs/states/Iowa.pdf], [https://openpv.nrel.gov/search]

[xiv] "Real Potential, Ready Today: Solar Energy in Iowa", Iowa Environmental Council, 2014 [http://iaenvironment.org/documents/2014/solarpub/RealPotentialReadyToday_pub_web.pdf]

[xv] 2015 State Solar Jobs Compendium, The Solar Foundation, 2015 [http://www.thesolarfoundation.org/solar-jobs-census/solar-jobs-compendium/]

[xvi] Iowa State Energy Profile, Us Energy Information Administration [http://www.eia.gov/state/print.cfm?sid=IA]

[xvii] "Biogas Potential in the US", National Renewable Energy Lab [http://www.nrel.gov/docs/fy14osti/60178.pdf]

[xviii] "Advantages of Anaerobic Digestion", NASKEO Environment [http://www.biogas-renewable-energy.info/anaerobic_digestion_advantages.html]

[xix] "The Economic Risks of Climate Change in The United States", Risky Business, 2015 [http://riskybusiness.org/reports/midwest-report/executive-summary]

[xix] "Advantages of Anaerobic Digestion", NASKEO Environment [http://www.biogas-renewable-energy.info/anaerobic_digestion_advantages.html]

[xx] ICF International

[xxi] Chittum, Anna, "How CHP Stepped Up When the Power Went Out During Hurricane Sandy", American Council for Energy-Efficient Economy, 2012 [http://aceee.org/blog/2012/12/how-chp-stepped-when-power-went-out-d]

[xxii] "Voter Attitudes Toward Energy Issues in Iowa: Key Findings from a Statewide Voter Survey", 2014, [http://energydistrict.org/images/uploads/2014-Midwestern-Energy-Issues-Survey-IOWA-RELEASE.pdf]

[xxiii] Mcandrew, Mitch, "Iowans struggle to pay heating bills" [http://www.dailyiowan.com/2014/12/03/Metro/40233.html]

[xxiv] Galluzzo, Teresa and Pearson, Beth, "Making Residential Energy Efficiency Accessible to Low-Income Iowans" [http://www.iowapolicyproject.org/2010docs/100506-EEResAccessW.pdf]
[xxv] Ibid
[xxvi] 2015 State Solar Jobs Compendium, The Solar Foundation, 2015 [http://www.thesolarfoundation.org/solar-jobs-census/solar-jobs-compendium-IA/]
[xxvii] "Burning Coal, Burning Cash: Ranking the States That Import the Most Coal", Union of Concerned Scientists, 2014 [http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/Burning-Coal-Burning-Cash-2014-Update-National-Findings.pdf]
[xxviii] "Dollars from Sense: The Economic Benefits of Renewable Energy", National Renewable Energy Lab [http://www.nrel.gov/docs/legosti/fy97/20505.pdf]
[xxix] Ibid
[xxx] Climate Change Overview, Iowa Department of Natural Resources [http://www.iowadnr.gov/Environment/ClimateChange.aspx]
[xxxi] "FACT SHEET: What Climate Change Means for Iowa and the Midwest", The White House, [https://www.whitehouse.gov/sites/default/files/microsites/ostp/IOWA_NCA_2014.pdf]
[xxxii] Pitt, David, "Iowa scientists: Drought a Sign of Climate Change", The USA Today, 2012 [http://www.usatoday.com/story/weather/2012/11/20/drought-climate-change-iowa/1717505/]
[xxxiii] "The Economic Risks of Climate Change in The United States", Risky Business, 2015 http://riskybusiness.org/reports/midwest-report/agriculture-climate-risk
[xxxiv] American Climate Prospectus [http://climateprospectus.org/]
[xxxv] "Nation's Waterways Operators Concerned about Impact of Drought Conditions, Low Water Levels", The American Waterways Operator", 2012 [http://www.americanwaterways.com/media/press/2012/nation%E2%80%99s-waterways-operators-concerned-about-impact-drought-conditions-low-water-0]
[xxxvi] "EPA Fact Sheet: Overview of the Clean Power Plan", US EPA [http://www2.epa.gov/sites/production/files/2014-05/documents/20140602fs-overview.pdf]
[xxxvii] "111(d) Emission Guidelines for Existing Power Plants:, The Iowa Department of Natural Resources [http://www.iowadnr.gov/InsideDNR/RegulatoryAir/GreenhouseGasEmissions/CarbonPollutionStandards.aspx]
[xxxviii] Schueneman, Thomas, " A Bump in the Road: Impact of the SCOTUS Clean Power Plan Decision", 2016, Triple Pundit [http://www.triplepundit.com/2016/02/bump-road-impact-scotus-clean-power-plan-decision/]
[xxxix] "G7 Leaders Agree to Phase Out Fossil Fuel Use by End of Century", The Guardian, 2015, [http://www.theguardian.com/world/2015/jun/08/g7-leaders-agree-phase-out-fossil-fuel-use-end-of-century]
[xl] Savenije , David," Hawaii legislature sets 100% renewable portfolio standard by 2045", Utility Dive, 2015 [http://www.utilitydive.com/news/hawaii-legislature-sets-100-renewable-portfolio-standard-by-2045/394804/]
[xli] "SB-350 Clean Energy and Pollution Reduction Act of 2015", California Legislative Information, 2015, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350]

[xlii] Pianin, Eric, "A Carbon Tax to Combat Global Warming is Getting a Fresh Look", The Fiscal Times, 2015 [http://www.thefiscaltimes.com/2015/07/05/Carbon-Tax-Combat-Global-Warming-Getting-Fresh-Look]
[xliii] Ballor, Jordan, "Why Big Oil Wants a Carbon Tax", The Federalist, 2015 [http://thefederalist.com/2015/06/29/why-big-oil-wants-a-carbon-tax/]
[xliv] 2015 State Solar Jobs Compendium, The Solar Foundation, 2015 [http://www.thesolarfoundation.org/solar-jobs-census/solar-jobs-compendium-IA/]
[xlv] "Benefits of Renewable Energy", Union of Concerned Scientists, [http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/public-benefits-of-renewable.html#.VVpcwvlViko]
[xlvi] Machol, Rizk, "Economic value of U.S. fossil fuel electricity health impacts", Environment International, 2013 [http://www.ncbi.nlm.nih.gov/pubmed/23246069]
[xlvii] "Annual Health Costs from Air Pollution", Center for Climate and Energy Decision Making, 2013 [http://cedmcenter.org/wp-content/uploads/2013/01/Impact-Comparison.pdf]
[xlviii] Diesendorf , Mark, "The Base Load Fallacy and other Fallacies disseminated by Renewable Energy Deniers", Energy Science Coalition, 2010 [http://www.energyscience.org.au/BP16%20BaseLoad.pdf]
[xlix] National Renewable Energy Lab (NREL) [http://www.nrel.gov/wind/systemsintegration/wwsis.html]
[l] Best Practices in State Net Metering Policies and Interconnection Procedures, Freeing the Grid, 2015 [http://freeingthegrid.org/]
[li] Energy Star Labeling Buildings and Plants, US EPA Energy Star [http://www.energystar.gov/index.cfm?fuseaction=labeled_buildings.showMap&search_owner_id=&search_prop_manager_id=&FILTER_B_ID=&building_type_id=ALL&zip=&search_spp_id=&year=&city=&profiles=&s_code=IA]
[lii] "Summary Of The Financial Benefits Of Energy Star® Labeled Office Buildings", US EPA Energy Star, 2006 [https://www.energystar.gov/ia/partners/publications/pubdocs/Summary_of_the_Financial_Benefits_23June06_FINAL.pdf]
[liii] Saving Energy and Money with Building Energy Codes in the United States, Energy Efficiency and Renewable Energy, US Department of Energy, http://energy.gov/sites/prod/files/2015/07/f24/Codes%20Fact%20Sheet%207-10-15.pdf
[liv] "Voter Attitudes Toward Energy Issues in Iowa: Key Findings from a Statewide Voter Survey", 2014, [http://energydistrict.org/images/uploads/2014-Midwestern-Energy-Issues-Survey-IOWA-RELEASE.pdf]