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Iowa Electric Generation

Condition of the State

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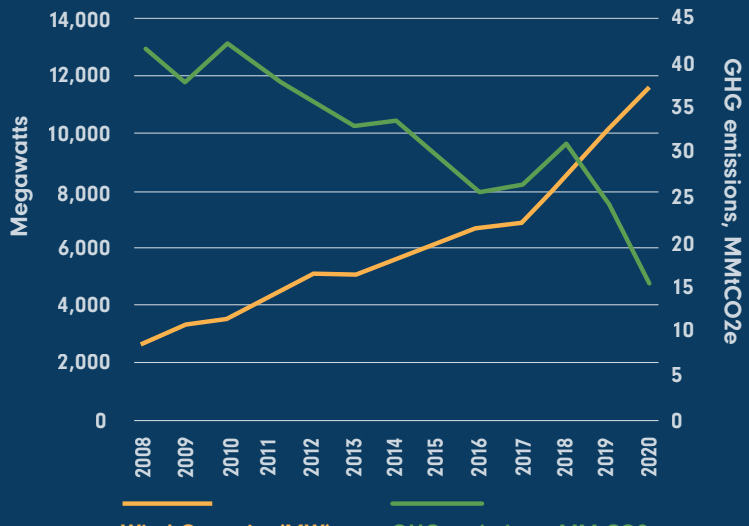
Introduction

With the recently announced long-term national policy to ensure the U.S. achieves a carbon-free electricity sector by 2035, states and utilities must explore how to greatly accelerate deployment of clean energy, and effectively eliminate electricity produced using coal and methane gas over the next fifteen years.[1] In April of 2020, the Iowa Environmental Council released *Iowa's Road to 100% Renewable,* which summarized various pathways to meet a 100% renewable energy goal based on a dozen regional and national studies. We found that this goal is achievable and desirable. In fact, wind energy surpassed coal as Iowa's primary source of electricity in 2019 for the first time ever, and provided 60% of the electricity in Iowa in 2020.

Chart 1: Iowa wind capacity growth compared to reductions in power sector greenhouse gas emissions.



However, Iowa is still host to six coal plants with no set retirement dates, and a goal of 100% renewable energy will ring hollow if the fossil-fired generation from coal and methane gas plants continues going forward.

Iowa's progress in developing renewable energy over the past twenty years has resulted in a significant reduction in carbon emissions in the electric generation or power sector. Greenhouse gas emissions from the power sector in Iowa declined by nearly 63% between 2008 and 2020 as the share of Iowa's electricity generated from wind grew from 8% to more than 60%.

This reduction moved the power sector from Iowa's top greenhouse gas emissions source in 2008 into third place behind agriculture and direct fossil fuel use in homes, businesses, and industry in 2019.[2] Although power sector greenhouse gas emissions increased between 2016 and 2018, they have declined by 50% since 2018.

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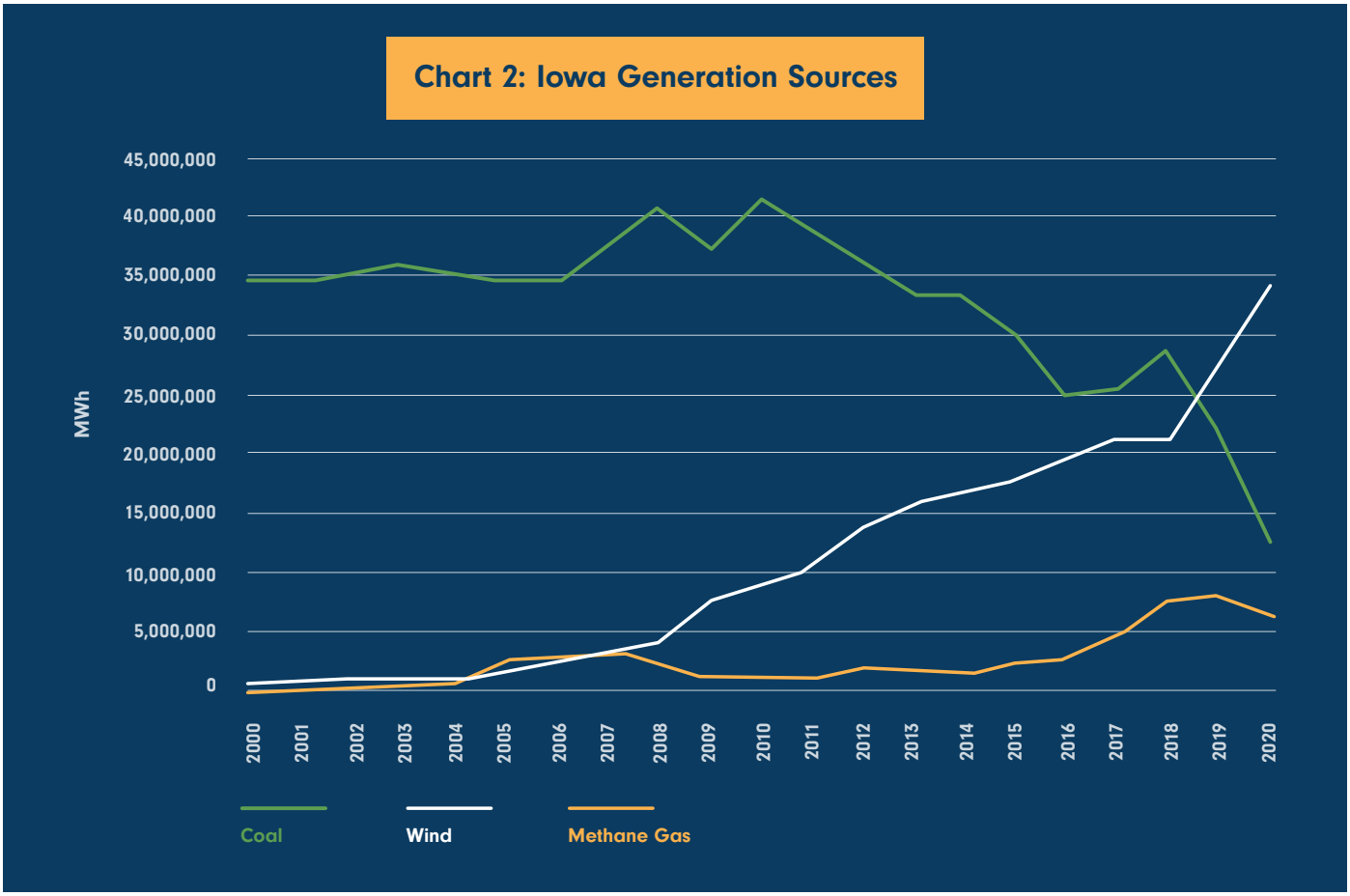
However, it will take additional investment in clean energy, energy efficiency, and complementary technologies to have a system that is carbon free 24 hours per day, seven days per week. MidAmerican Energy and Alliant must make serious commitments to reach a zero-carbon electricity system by 2035 and be a part of driving the needed innovation to reach the critical climate change milestones, starting with plans to retire their expensive, dirty, and unnecessary coal generation.

Iowa Generation Since 2000

Iowa has made significant progress in reducing generation from coal-fired power plants since 2000 and has seen a significant increase in generation from wind. The increase in generation from methane gas has coincided with the construction of new combined cycle methane gas power plants.

Chart 2: Iowa Generation Sources



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The 2016 to 2020 timeframe is especially noteworthy because renewable generation from wind not only exceeded coal generation for the first time, but was 60% of Iowa's generation in 2020 – the most of any state in the U.S.

Chart 3: 2020 MidAmerican Resource Mix

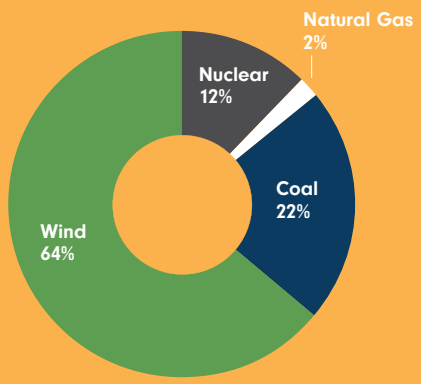
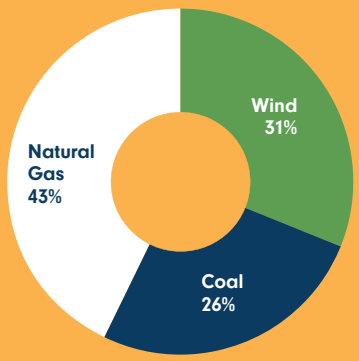
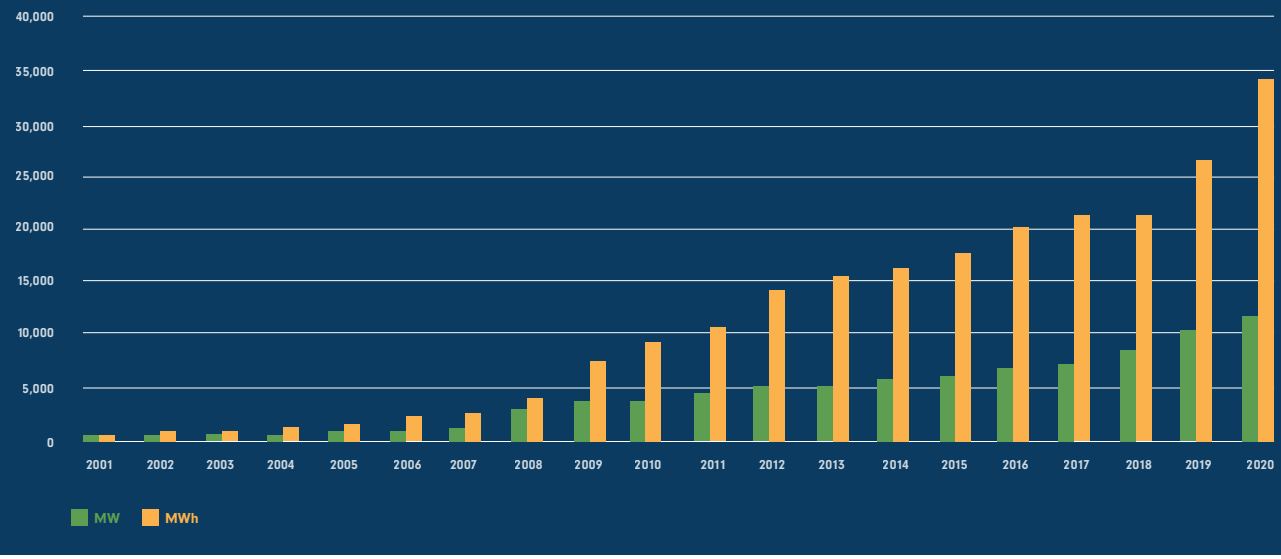


Chart 4: 2020 Alliant Resource Mix



The 2020 Iowa resource mixes for Iowa's two largest utilities, Alliant Energy and MidAmerican Energy, are shown in Chart 3 and 4.[3] Wind represented 64% of the MidAmerican Energy generation and 31% of the Alliant Energy generation. The graph below shows the total wind capacity (MW) in Iowa since 2001 and the generation (MWh) from those wind turbines, including the notable 2016 to 2020 timeframe.[4] [5]

Chart 5: IOWA WIND Capacity (MW) vs Generation (MWH)



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Wind represented 64% of the MidAmerican Energy generation and 31% of the Alliant Energy generation. From 2016 to 2020, wind capacity increased by over 68% (an additional 4,743 MW) in Iowa, and wind generation increased more than 70%.

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Fossil Generation

Alliant has increased production at Marshalltown (MGS) and Emery (methane gas fired combined cycle power plants) since 2017 while reducing production from all of its coal plants. MidAmerican increased production at Greater Des Moines (methane gas fired combined cycle power plant) while reducing production at all of its coal plants. From 2018 to 2020, Alliant reduced its overall fossil electricity production by 27% while MidAmerican reduced its fossil electricity production by 52%. In 2020, fossil generation represented 26% of MidAmerican generation and 69% of Alliant generation. Charts 6 and 7 offer a comparison of the generation from each fossil power plant over time; it is easy to see both the variability in deployment of fossil resources but also the clear general trend of decreasing use of coal plants over time.[6]

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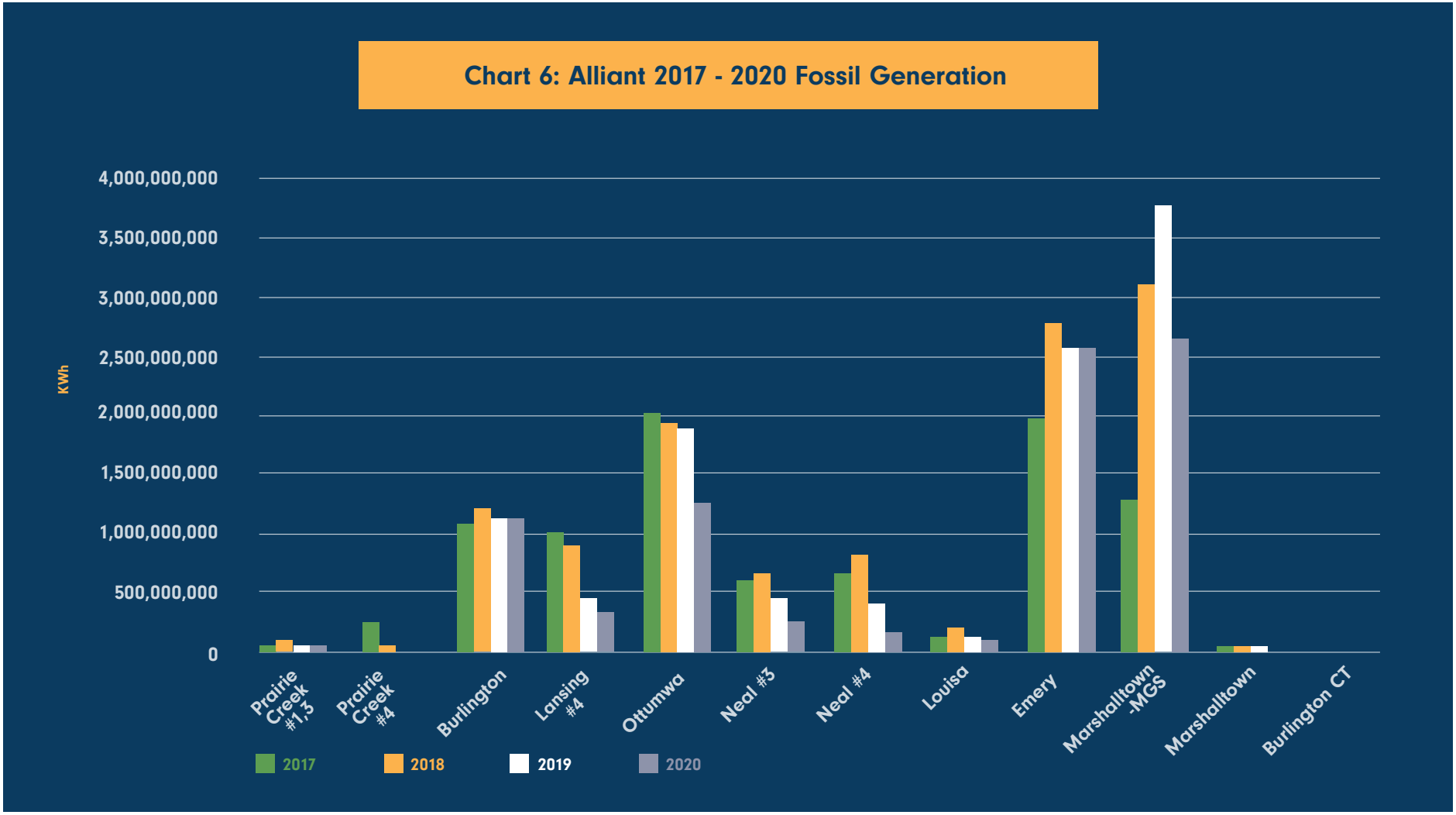

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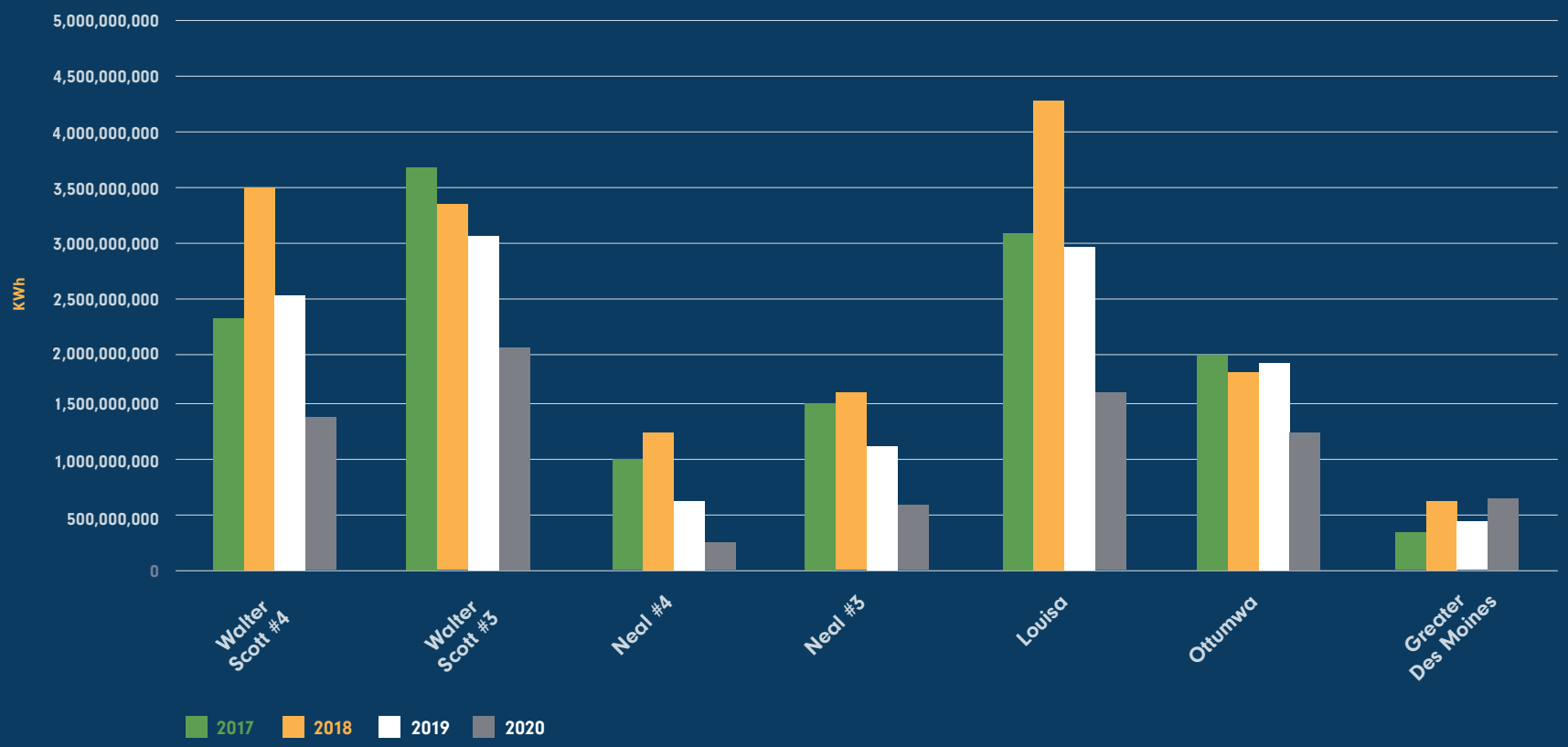
Chart 7: MidAmerican 2017 - 2020 Fossil Generation



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Iowa Retail Load

To meet a 100% renewable goal, most people believe this to mean that you will use renewable generation to provide all of your generation in every hour of the day, year-round. However, as covered in *Iowa Electric Generation, Condition of the State, October 2020*, this is not how MidAmerican is defining its goal to deliver 100% renewable energy to Iowa customers by 2021. MidAmerican is not being transparent on defining the goal, and is actually talking about offsetting 100% of the retail customer load. The electricity used by customers establishes the utility retail load. However, MidAmerican and Alliant also sell electricity to other utilities. The sales of electricity to other utilities are classified as "sales for resale," and are not considered sales to customers.

By looking at the electric generation produced in Iowa by MidAmerican and Alliant for the years 2016 through 2020, we can see in Chart 8 what portion of the generation is serving Iowa customers, and what portion is serving the financial interests of MidAmerican and Alliant.[7]

For 2020, MidAmerican sold 26.5 million MWh to its customers and Alliant sold 13.9 million MWh to its Iowa customers. For MidAmerican and Alliant, the portion of the electricity they generate in Iowa being sold to other utilities is substantial, with 29% of MidAmerican's 2020 generation being sold to out of state utilities and 20% of the Alliant 2020 generation being sold to out of state utilities. MidAmerican sold more than 11.2 million MWh to utilities in 2020 for $124.3 million, while Alliant sold almost 3.7 million MWh to utilities for $103.6 million.

Iowa Electric Generation

It is well-understood that coal is the most environmentally damaging fuel to use for electricity generation due to air and water pollution and high carbon emissions.

In total, MidAmerican and Alliant generated, or purchased, the following in 2020 categorized by the type of generation:

Table 1: MidAmerican 2020 Generation (MWh)

Coal	7,222,282
Methane Gas	674,976
Nuclear	3,927,175
Other	5,982,328
Wind	20,660,041
Total	**38,466,802**

Table 2: Alliant 2020 Generation (MWh)

Coal	3,211,445
Methane Gas	5,270,252
Other	6,015,820
Wind	3,842,894
Total	**18,340,316**

As noted above, the electricity sold to Iowa customers (retail load) was only a portion of the 2020 generation in Iowa. Since the generation is categorized by resource, the environmental impacts from the different resources can be quantified.

It is well-understood that coal is the most environmentally damaging fuel to use for electricity generation due to air and water pollution and high carbon emissions. If we consider the true cost of environmental externalities from health impacts and a changing climate, as well as the overall cost, coal should be the last resort, not the default or "baseload" for generation. With that in mind, the amount of excess coal generation (coal generation not serving Iowa customers or being sold to other utilities that could be offset using other sources) can be calculated. The excess coal generation for MidAmerican and Alliant in 2020 is shown in Tables 3 and 4.

Table 3: MidAmerican 2020 Excess Coal Generation

	MWh
2020 MidAmerican Customer Load	26,523,317
Subtract the Generation from Wind	20,660,041
Subtract the Generation from Nuclear	3,927,176
Subtract the Generation from Other Resources	5,982,328
Subtract the Generation from Methane Gas	674,976
Total 2020 Customer Load Not Served by Resources Listed Above	0
Subtract the 2020 MidAmerican Coal Generation	7,222,282
Total MidAmerican Excess Coal Generation	**7,222,282**

Table 4: Alliant 2020 Excess Coal Generation

	MWh
2020 Alliant Customer Load	13,864,405
Subtract the Generation from Wind	3,842,894
Subtract the Generation from Other Resources	6,015,820
Subtract the Generation from Methane Gas	5,270,252
Total 2020 Customer Load Not Served by Resources Listed Above	0
Subtract the 2020 Alliant Coal Generation	3,211,350
Total Alliant Excess Coal Fueled Generation	**3,211,350**

In 2020, ***all of the coal generation for MidAmerican and Alliant was excess.*** That means that the 2020 production from Neal #3, Neal #4, Louisa, Walter Scott #3, Walter Scott #4, Ottumwa, Prairie Creek #4 and Lansing #4 was not needed for Iowa customers and could have been provided with other less polluting sources. The amount of MidAmerican and Alliant excess coal generation appears to be neither necessary, nor consistent with stated reasons for continuing to operate the coal plants. MidAmerican has claimed:

> *"MidAmerican Energy will continue to use its natural gas, nuclear and coal-fueled plants to ensure reliable electric service even in times of low wind."* [8]

Unless MidAmerican provides greater transparency and data that supports its position that the coal plants are operating for purposes of ensuring reliability, it appears the coal plants are in fact being operated in order to sell to other utilities to increase revenues.

Impacts to Iowans from Excess Coal Generation

Unlike renewable generation, all fossil electricity generation impacts Iowa's environment. Although methane gas generation negatively impacts our environment, coal generation not only degrades the air we breathe and

drives climate change, but also produces a substantial amount of solid waste that is landfilled in Iowa. In 2020, the total excess coal generation from both utilities was 10,433,632 MWh, resulting in harmful emissions unnecessarily released into the air we breathe, and toxic fly ash waste placed in Iowa landfills. Table 5 shows the excess emissions and waste from the Alliant and MidAmerican operated coal plants in 2020.

Table 5: Alliant & MidAmerican 2020 Coal Fueled Plant Emissions

	Alliant[9]	MEC[10]	Total
Excess Sulfur Dioxide (tons)	4,389	12,614	17,003
Excess Nitrogen Oxides (tons)	2,254	7,659	9,913
Excess Mercury (lbs)	25	33	58
Excess Carbon Dioxide (tons)	5,048,086	12,294,417	17,342,503
Excess Fly ash (tons)	32,644	130,256	162,900

Impacts to Iowans from Excess Air Emissions

Air pollution from coal-fired power plants is linked with asthma, cancer, heart and lung ailments, neurological problems, acid rain, climate change, and other severe environmental and public health impacts. Air pollution and climate change are two of the most serious.

Coal Generation and Air Pollution

When coal burns, the chemical bonds holding its carbon atoms in place are broken, releasing energy. However, other chemical reactions also occur, many of which carry toxic airborne pollutants and heavy metals into the environment. This air pollution includes:

Mercury: Coal plants are responsible for ***44 percent of US mercury emissions.***[11] Mercury is a toxic heavy metal that can damage the nervous, digestive, and immune systems, and is a serious threat to child development.[12] Just 1/70th of a teaspoon of mercury deposited on a 25-acre lake can make the fish unsafe to eat. In 2020, excess coal generation in Iowa was responsible for emitting **58 pounds** of mercury into Iowa's air.

Sulfur dioxide (SO2): Produced when the sulfur in coal reacts with oxygen, SO_2 combines with other molecules in the atmosphere to form small, acidic particulates that can penetrate human lungs. It is linked with asthma, bronchitis, smog, and acid rain, which damages crops and other ecosystems, and acidifies lakes and streams.[13] In 2020, the excess coal generation in Iowa was responsible for emitting **17,003 tons** of sulfur dioxide into Iowa's air.

Nitrogen oxides (NOx): Nitrogen oxides are visible as smog and irritate lung tissue, exacerbate asthma, and make people more susceptible to chronic respiratory diseases like pneumonia and influenza.[14] In 2020, the excess coal generation in Iowa was responsible for emitting **9,913 tons** of nitrogen oxides into Iowa's air.

Particulate matter: Better known as "soot," this is the ashy grey substance in coal smoke, and is linked with chronic bronchitis, aggravated asthma, cardiovascular effects like heart attacks, and premature death.[15]

Coal plant emissions are increasingly being recognized as significantly impacting our health, and are silent killers. In economics, an externality is a cost or benefit that is imposed on a third party who did not agree to incur that cost or benefit. When the captive customers of MidAmerican and Alliant pay for their power, they certainly are not agreeing to health impacts or death as a part of the deal. Yet, the externalities of MidAmerican and Alliant burning coal can be quantified in terms of the impacted population and the economic impact using the EPA CO-Benefits Risk Assessment (COBRA) screening tool. When the EPA model is run for the coal plants in Iowa, the results are shown in Table 7.

Table 7: COBRA Results for Iowa Coal Generation

	Change in Incidence (cases, annual)		Monetary Value*** (dollars, annual)	
Health Endpoint	Low	High	Low	High
Mortality *	5.821	13.152	$63,699,841	$143,925,310
Nonfatal Heart Attacks *	0.580	5.386	$92,799	$861,529
Infant Mortality	0.025	0.025	$301,337	$301,337
Hospital Admits, All Respiratory	1.382	1.382	$54,725	$54,725
Hospital Admits, Cardiovascular **	1.935	1.935	$56,526	$56,526
Acute Bronchitis	7.642	7.642	$4,715	$4,715
Upper Respiratory Symptoms	137.880	137.880	$5,891	$5,891
Lower Respiratory Symptoms	97.061	97.061	$2,621	$2,621
Emergency Room Visits, Asthma	3.416	3.416	$952	$952
Asthma Exacerbation	143.794	143.794	$10,671	$10,671
Minor Restricted Activity Days	3,714.190	3,714.190	$325,604	$325,604
Work Loss Days	626.728	626.728	$125,463	$125,463
Total Health Effects			**$64,681,145**	**$145,675,343**

* The Low and High values represent differences in the methods used to estimate some of the health impacts in COBRA. For example, high and low results for avoided premature mortality are based on two different epidemiological studies of the impacts of PM2.5 on mortality in the United States.

** Except heart attacks.

*** Based on 2017 dollars.

The results of burning coal in Iowa means that five to as many as 13 Iowans are dying prematurely every year. When the economic impacts of coal burned by MidAmerican and Alliant are quantified, Iowans are being burdened with health care costs ranging from **$64,681,145** to **$145,675,343** per year.

Coal Generation and Climate Change

Of coal's many environmental impacts, none are as harmful, long term, and irreversible as climate change. Climate change is driven by emissions of heat-trapping gases, primarily from human activities, that rise into the atmosphere and act like a blanket, warming the earth's surface.

> **Carbon dioxide** (CO2) emissions from combusting fossil fuels are the main driver of climate change. CO2 is also the main byproduct of coal combustion: nearly four grams of CO2 are produced for every gram of carbon burned (depending on its type, coal can contain as much as 60 to 80 percent carbon).

Consequences include rising temperatures and accelerating sea level rise, as well as growing risks of drought, heat waves, heavy rainfall from intensified storms, and species loss. Left unchecked, climate change will lead to profound human and ecological disruption. We are already seeing impacts from climate change today in Iowa.

These impacts are costing Iowa businesses, families, governments and taxpayers billions of dollars. Just one event, the August 10, 2020 derecho, damaged millions of acres of corn and soybeans, devastated the Cedar Rapids tree canopy, and crippled portions of the MidAmerican and Alliant electric system. The resulting damages to Iowans and Midwesterners totaled $11 billion.

The social cost of carbon is a measure of the economic harm from these impacts, expressed as the dollar value of the total damages from emitting one ton of carbon dioxide into the atmosphere. The current average social cost of carbon, as established by the federal government's Interagency Working Group on the Social Cost of Greenhouse Gases (IWG), is $51 per ton in today's dollars, with a social cost of carbon of $152 per ton at the 95th percentile.[16] Many experts believe this is far lower than the true costs of carbon pollution.

In 2020, the excess coal generation in Iowa was responsible for emitting **17,342,503 tons**[17] of carbon dioxide into the atmosphere representing economic harm ranging from **$884,467,653** to **$2,636,060,456.**

Coal Generation and Crop Yields

As covered in more depth in *Iowa Electric Generation, Condition of the State, October 2020*, another potentially significant consequence of MidAmerican and Alliant's choice to unnecessarily burn coal is the negative impact on crop yields. A recent study looked at the increases in crop yields that occurred when coal plants shut down.[18]

The study found that counties in the U.S. that experienced a coal plant closure in their immediate vicinity not only reduced mortality rates, but increased corn yields by 1.1% over the study period of 2005 to 2016. The study then estimated the impacts of the remaining coal-fired units still operating, assuming that their impacts are the same as those that have been decommissioned.

The study concluded that mortality rates would decrease by rates consistent with the results from the EPA COBRA model discussed previously, and corn production would increase. More than two-thirds of Iowa counties experienced annual production losses ranging from 1 million bushels to 5 million bushels due to the continued operation of the MidAmerican and Alliant coal plants. The estimated annual corn production loss from the remaining 4,384 MW of coal is quantified in Table 8.

Table 8: Estimated Annual Corn Lost Because of Operating 4,384 MW of Coal

	Ten Year Corn Production Loss (MBu)	Annual Loss per County (MBu)	2/3 of Counties	Annual Statewide Corn Loss (Bu)	Value Based on 2021 Avg of $5.58/bu[19]
Minimum Loss	10	1	66	66 Million	$368,280,000
Average Loss	50	5	66	330 Million	$1,841,400,000

Iowans are paying with their lives, health, and safety and farmers are paying a significant corn production penalty from unnecessary coal plant pollution. As covered in *Iowa Electric Generation, Condition of the State, October 2020*, the case is clear that shutting down Iowa's remaining coal plants and replacing them with wind and solar would be a net positive for corn production even when accounting for the land that will be shifted into producing renewable energy. Such a shift would result in net increased corn production of between 21 and 285 million bushels statewide annually. The increase in corn production and farm revenue makes the retirement of MidAmerican and Alliant's remaining coal fleet a no-brainer for Iowa's agricultural economy.[20]

Impacts to Iowans from Excess Solid Waste

As noted above, in 2020 MidAmerican and Alliant are estimated to have sent **162,900 tons** of excess fly ash to landfills. The landfills are special waste landfills called monofills that only accept coal combustion residue. Fly ash is a coal combustion waste that is composed of the particulates (fine particles of burned fuel) that are driven out of coal-fired boilers together with the flue gases. Fly ash is captured by electrostatic precipitators or other particle filtration equipment.

Regardless of the waste produced, there are many toxic substances present in coal ash that can cause major health problems in humans. Some toxic constituents found in coal ash, including coal ash from MidAmerican and Alliant coal plants, are arsenic, boron, cadmium, chromium, cobalt, copper, lead, lithium, mercury, molybdenum, selenium, thallium and uranium.[21]

Although the monofill facilities are permitted and regulated by the Iowa Department of Natural Resources (IDNR), once the coal combustion residue is landfilled, it poses a perpetual risk of potentially impacting Iowa's groundwater. It is a near-certainty that such contamination will occur at some point as long as the residue is present in the landfill. One example of such pollution is the groundwater surrounding the Neal South monofill, which was found to have elevated levels of arsenic.[22] MidAmerican was directed by the Iowa Department of Natural Resources to take corrective action to stop this contamination. MidAmerican injected chemicals into the soils surrounding the monofill, intending to immobilize the arsenic in the subsurface soils and prevent future migration of dissolved arsenic in groundwater.[23]

The True Cost of Coal Generation

As discussed previously, MidAmerican and Alliant's continued buring of coal negatively impacts the financial well-being of every Iowan and does not account for the externalities of burning coal. The financial impact to Iowan's health, crop loss, and climate impact is summed in Table 9.

Table 9: Cost of Externalities from Operating 4,384 MW of Coal

	Minimum	Maximum
Health Costs	$64,681,145	$145,675,343
Corn Loss Costs	$368,280,000	$1,841,400,000
Social Cost of CO_2	$865,833,317	$2,580,522,826
TOTAL	$1,317,428,798	$4,623,598,169
$/kwh*	$0.13	$0.44

*The total costs of the externalities divided by the 10,433,632,000 kwh of excess coal generation.

By not accounting for the externalities of burning coal, MidAmerican and Alliant burden their captive customers with clear financial impacts. The true costs of production at the MidAmerican and Alliant coal plants are shown in Chart 9, and contrasted with the cost of production from the wind farms.

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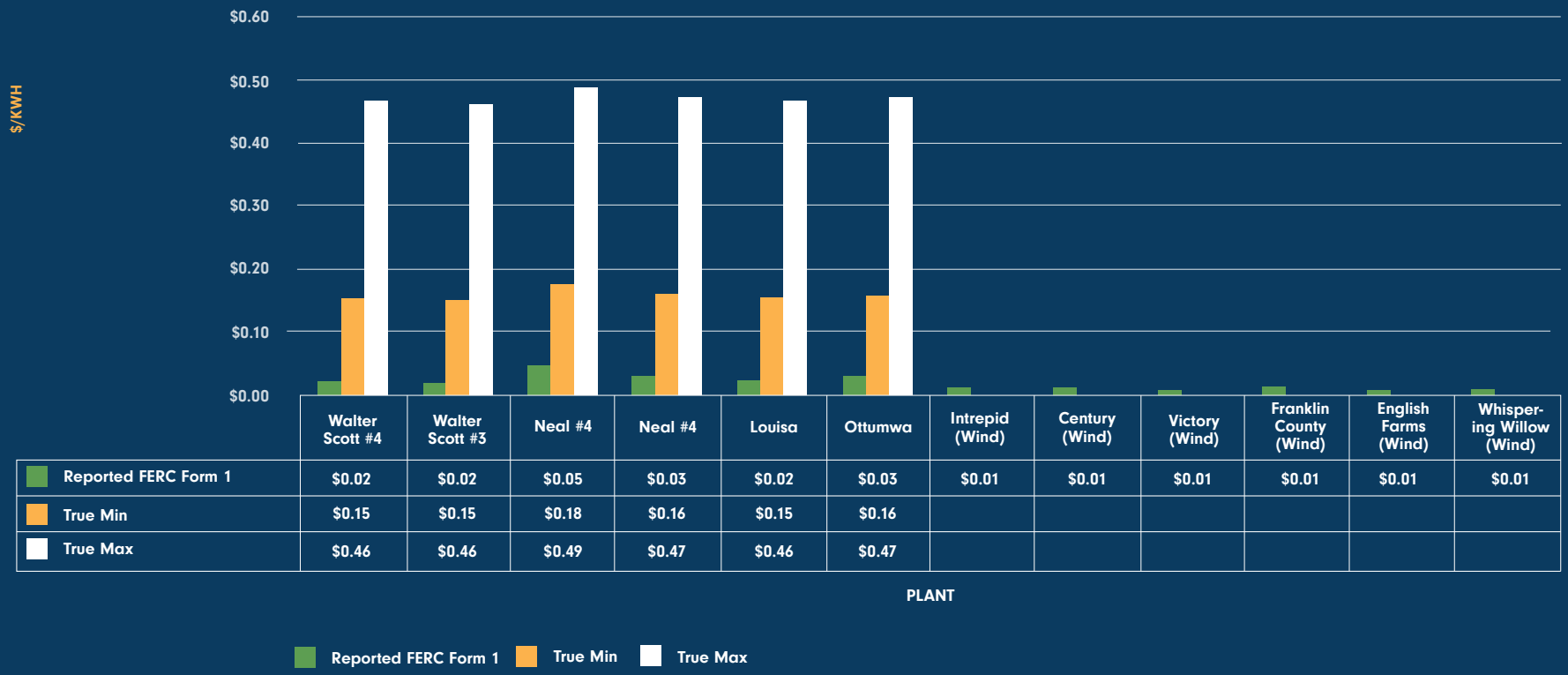
Chart 9: Iowa Plant 2020 Production Costs $/kwh



	Walter Scott #4	Walter Scott #3	Neal #4	Neal #4	Louisa	Ottumwa	Intrepid (Wind)	Century (Wind)	Victory (Wind)	Franklin County (Wind)	English Farms (Wind)	Whisper-ing Willow (Wind)
Reported FERC Form 1	$0.02	$0.02	$0.05	$0.03	$0.02	$0.03	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
True Min	$0.15	$0.15	$0.18	$0.16	$0.15	$0.16						
True Max	$0.46	$0.46	$0.49	$0.47	$0.46	$0.47						

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A true and transparent accounting by MidAmerican and Alliant would consider the broader range of costs borne by their captive customers of generating power using coal. The MidAmerican and Alliant coal plants are clearly not cost competitive when compared to the MidAmerican and Alliant renewables. Wind is the lowest-cost source of generation and is dramatically lower than the true costs of the MidAmerican and Alliant coal plants.[24] Accounting for the externalities in the cost of the generation makes the continued operation of already uneconomic coal generation even more unreasonable and represents an unrecognized financial burden on captive utility customers.

Conclusion

Iowa has been a clean energy leader over the past 20 years, deploying significant amounts of wind energy and, as a result, reducing electric-sector greenhouse gas emissions significantly as well. We have the natural wind and solar resources to reach 100% renewable energy. Unfortunately, due to misleading utility marketing efforts many Iowans believe we are already approaching 100% renewable energy. The truth is, we have a long way to go to achieve a true 100% renewable vision and, in the meantime, the continued use of coal generation has consequences that impact every Iowan.

The threats to air quality and potential contamination of groundwater are known, quantifiable, and unnecessary. The direct damages to agricultural productivity are just beginning to be understood and the severe threats we face from climate change in our state are already evident and cannot be allowed to expand unchecked. A true and transparent accounting by MidAmerican and Alliant would consider the full range of costs borne by their captive customers of generating power using coal.

Right now, Iowa utilities are burning coal for profit at the cost of Iowans' health and livelihoods, even as a switch to clean energy could reduce both pollution and costs for consumers while increasing farm income and productivity. The pursuit of 100% renewable energy starts with an honest accounting, full disclosure, and the complete elimination of unnecessary, dirty coal generation. Only with that full accounting can Iowa continue solidly down the path we have begun toward 100% renewable energy.

Endnotes

1 Fact Sheet: Biden Sets Greenhouse Gas Reduction Targets

2 Iowa Department of Natural Resources, 2019 Iowa Statewide Greenhouse Gas Emissions Inventory Report (2020) available at https://www.iowadnr.gov/Environmental-Protection/Air-Quality/Greenhouse-Gas-Emissions.

3 2020 Q4 FERC Form 1

4 https://windexchange.energy.gov/maps-data/321

5 https://www.eia.gov/electricity/data/browser/

6 2016, 2017, 2018, 2019 and 2020 Q4 FERC Form 1, Alliant and MidAmerican

7 2016, 2017, 2018, 2019 and 2020 Q4 FERC Form 1, Alliant and MidAmerican

8 https://www.midamericanenergy.com/nr-100percentrenewable

9 Governance and performance data - Powering What's Next (alliantenergy.com), and 2020 ARP monitoring

10 https://www.brkenergy.com/assets/pdf/sustainability-midamerican-energy-2020.pdf, and 2020 ARP monitoring.'

11 https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects

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13 https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects

14 https://www.epa.gov/no2-pollution/basic-information-about-no2#Effects

15 https://www3.epa.gov/region1/airquality/pm-human-health.html

16 FAQ – What is the SCC? – The Cost of Carbon Pollution

17 Based on Acid Rain Program Continuous Emissions Monitors at Iowa Coal Plants for 2020

18 "The downstream air pollution impacts of the transition from coal to natural gas in the United States", Jennifer A. Burney, School of Global Policy and Strategy, University of California, San Diego., https://www.nature.com/articles/s41893-019-0453-5; "Author Correction: The downstream air pollution impacts of the transition from coal to natural gas in the United States", https://www.nature.com/articles/s41893-020-0548-z

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20 Iowa Electric Generation, Condition of the State, October 2020

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23 Id.

24 Vibrant Clean Energy, Energy Innovation, The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources (2019) at https://energyinnovation.org/wp-content/uploads/2019/03/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL.pdf.

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