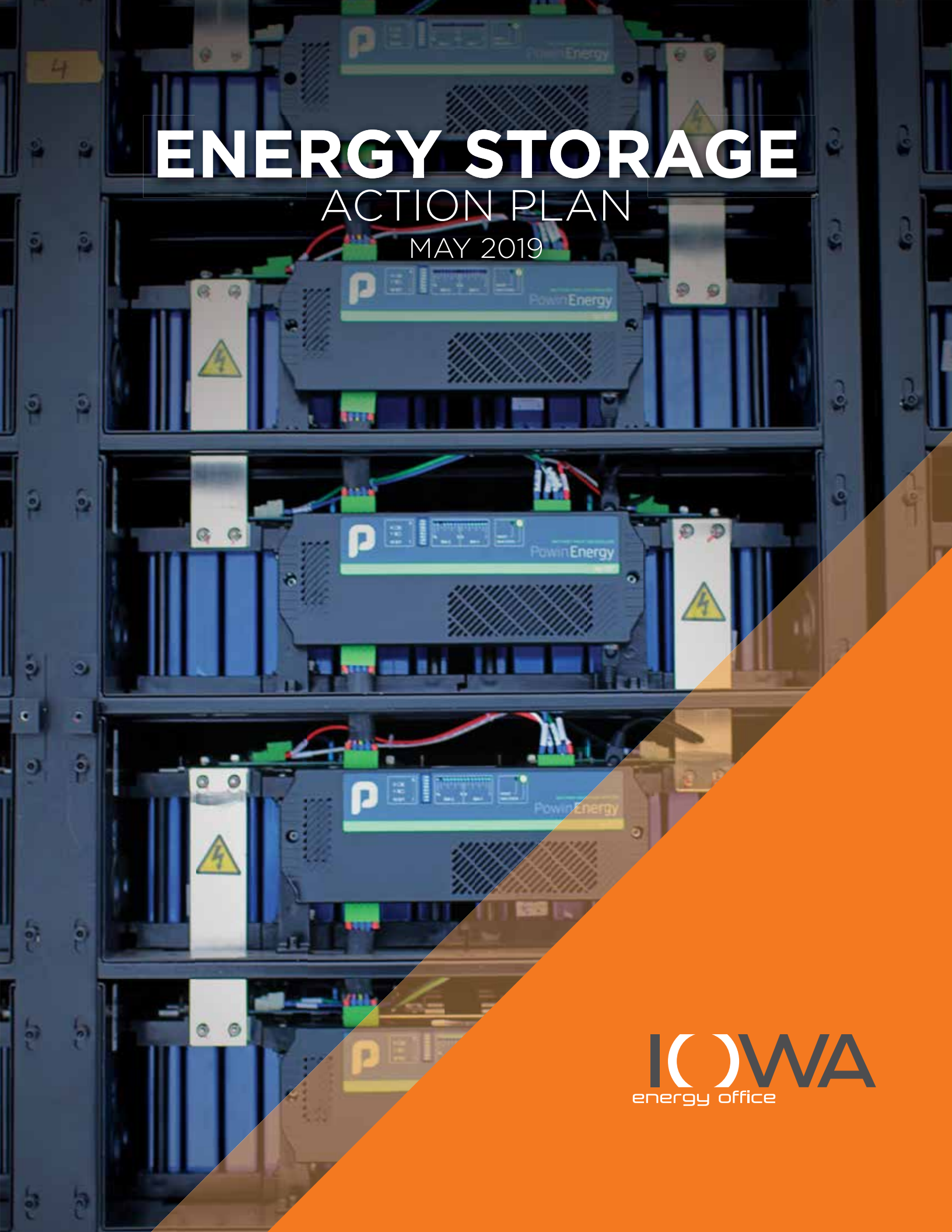

ENERGY STORAGE
ACTION PLAN
MAY 2019

IOWA
energy office

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INTRODUCTION

The Iowa Economic Development Authority's (IEDA) Iowa Energy Office, with support from energy stakeholders, hit the ground running and is prepared to tackle new challenges and opportunities. The state of Iowa will undoubtedly continue to be a leader in renewable energy in 2019, but it's important to look over the horizon and explore the next great endeavor.

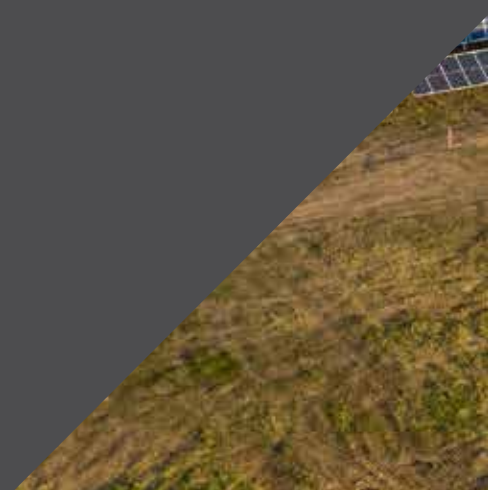
Throughout 2018, IEDA collaborated with Iowa's energy industry stakeholders and utilized the Iowa Energy Plan as a compass for implementation. One effort led by the Energy Office was learning more about the emerging technologies surrounding energy storage. This initiative examined various types of energy storage, as well as the benefits across the industry. Whether a utility-scale or a residential application, energy storage is appealing for a variety of reasons, including cost savings, resiliency potential and grid stability.

This plan outlines the first step towards better understanding this new technology. The plan is intended to be informational, educational and a kick-start conversation generator regarding how to best utilize energy storage in Iowa. Additionally, the intent is that the recommendations will spark action in removing any barriers that may exist to smooth the path of implementation.

By preparing now, Iowa will maintain its national role as an energy leader and be poised to capture the potential economic benefits that accompany energy storage.

Sincerely,

Debi V. Durham
Director
Iowa Economic Development Authority

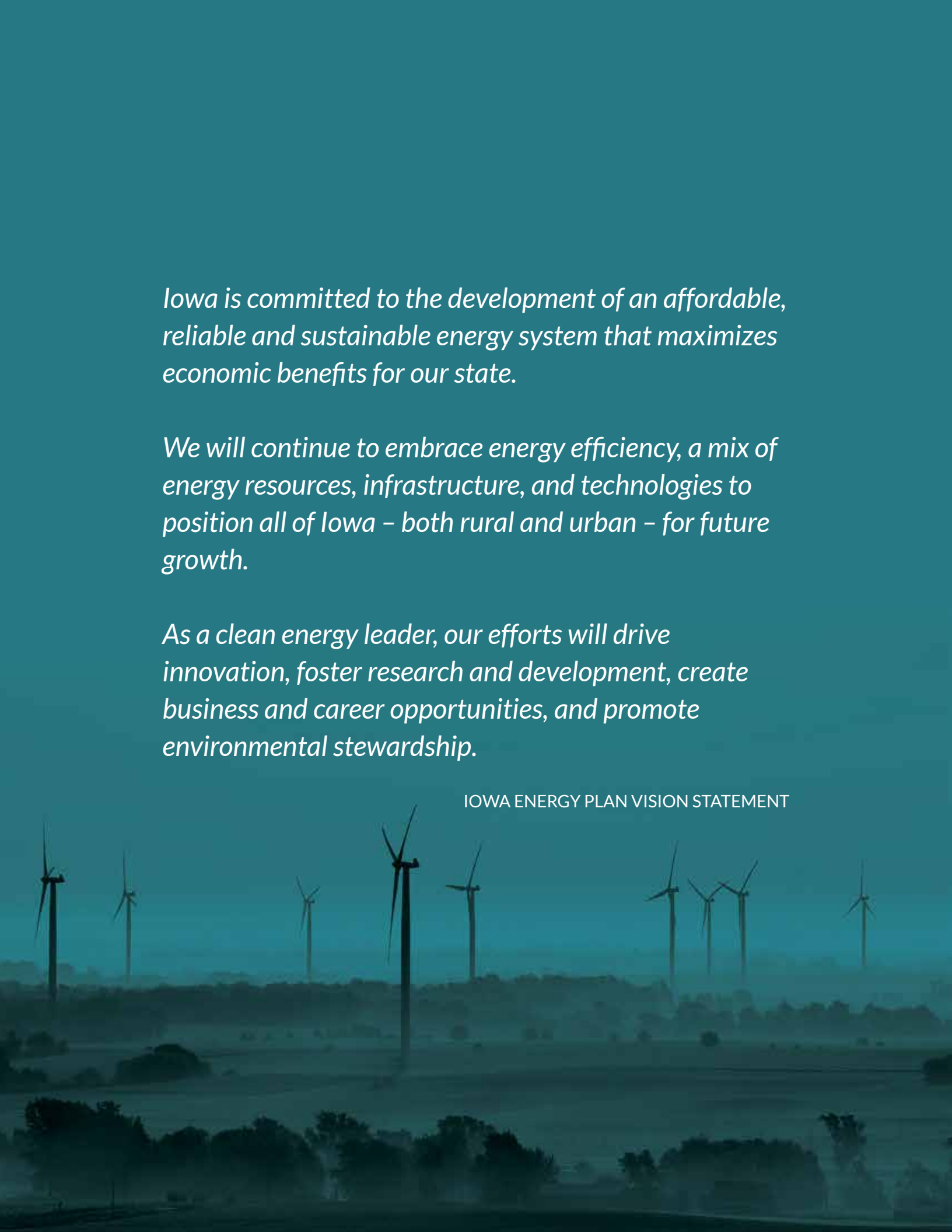


Iowa is committed to the development of an affordable, reliable and sustainable energy system that maximizes economic benefits for our state.

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

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

IOWA ENERGY PLAN VISION STATEMENT



FORMATION OF THE 2018 IOWA ENERGY STORAGE COMMITTEE

The Iowa Energy Plan sparked great energy discussions among stakeholders across the state and throughout the industry. Technology-based energy research and development is one of seven key areas of the plan where the energy storage conversation began. In early 2018, the Iowa Energy Office commenced outreach efforts with a diverse group of industry stakeholders, all of whom offer unique backgrounds and perspectives to form the Iowa Energy Storage Committee. The 17-member committee represents varying industry groups to purposefully hear and realize different points of view. The group includes environmental organizations, academia, business and industry, state organizations, utilities, solar, wind, transmission and distribution, regulatory, labor interests and the Iowa National Guard.

The Energy Storage Committee met three times in 2018 to educate industry peers on storage efforts and perspectives. The definitive plan was to devise recommendations on how Iowa should prepare and embrace storage as a technology with immense economic potential. The plan's goal was to guide policymakers and relevant stakeholders to initiate conversations that result in impactful outcomes in the future.

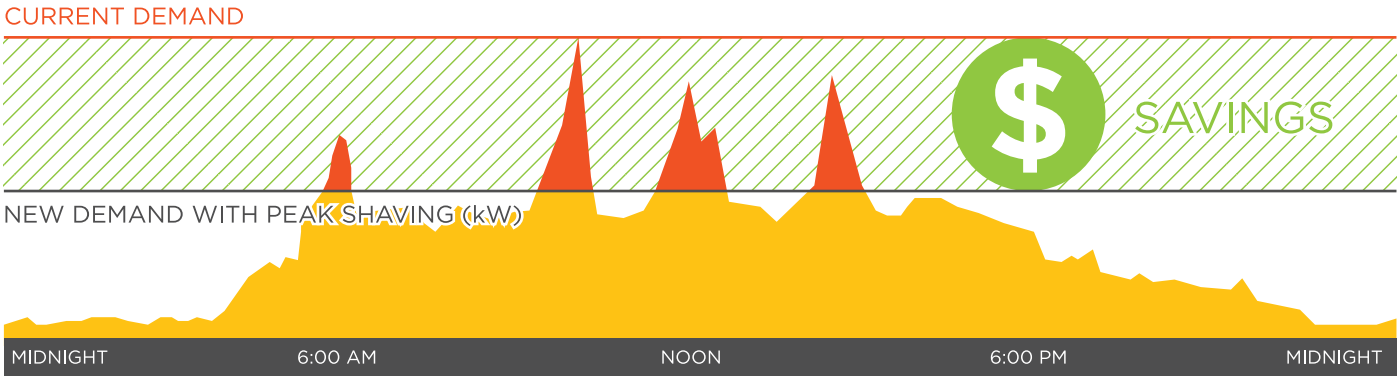
STORAGE OVERVIEW

Energy storage originates from many forms and applications, including pumped hydroelectric, compressed air, thermal and batteries, to name a few. An example of pumped hydroelectric involves allowing water in an upper reservoir to flow to a lower reservoir creating electricity. During times of low demand when electricity costs are lower, typically at night, water is pumped back to the upper reservoir, and the process repeats. This mature technology has been around since the 1920's, but is typically reserved for specific geographies due to the need for large amounts of water and drops in elevation.

Compressed air energy storage (CAES) involves storing potential energy as compressed air, which is stored in large storage tanks or naturally occurring underground geological formations like mined hard rock caverns or very porous aquifers. At times of peak demand, the compressed air is released and expanded in a conventional gas turbine to generate electricity. The principle is the low-cost energy used to compress the stored air replaces the high cost energy that would otherwise be used to compress air within the gas turbine. Iowa was involved in a proposed 270-Megawatt (MW) CAES project[1], but the geological limitations of the proposed aquifer, combined with the economics, policy, legislative and market forces were too challenging to overcome at the time when the final report was released in 2012.

Thermal energy storage is used in demand response programs to reduce peak through use of an array of technologies. Some rural electric cooperatives in Iowa developed programs using residential electric water heaters to assist with load management. Ice storage is another example of thermal energy storage; water is frozen at night when electricity costs are lower, and the thawing ice water is utilized in HVAC units to cool the air for air conditioning. This process provides cost effective cooling systems.

REDUCING PEAK DEMAND THROUGH PEAK SHAVING



SOURCE: https://act-chargers.com/wp-content/uploads/2017/03/ACT-White-Paper-Energy-Management-through-Peak-Shaving-and-Demand-Response.pdf

These technologies and descriptions educate and convey that energy storage has multiple definitions. For the purposes of this plan and to help guide the discussion, when energy storage is referenced, it refers to batteries, regardless of the form, that store energy for later use. A variety of battery types and sizes are available and battery technology is continually advancing. The storing of electricity or energy for later use makes batteries valuable regardless of the form. Batteries are being more frequently utilized as daily lives and activities become more electrified, which drives technology advances that lowers the cost and increases the supply of batteries in the market. The upward trend in popularity of electric vehicles (EV) is another reason for the increased demand for batteries. Storage system costs are expected to continue to decline 8 percent annually through 2022[2]. These systems are popular as a standalone asset, or paired with renewable energy projects, due to the ability to compensate for some intermittency that is inherent with renewable energy. These also provide peak shaving capabilities and other grid service benefits like real-time grid balancing and resiliency. As hard costs (ex. materials, equipment and other tangible aspects) of storage continue to trend downward nationally, the soft costs (ex. fees, financing) can be impacted at a local level to further allow for the rapid adoption and deployment of energy storage in Iowa.

Peak shaving is a key factor that makes batteries attractive to energy users. With demand charges typically accounting for 30 to 70 percent of a commercial electricity bill[3], storage allows energy users to "shave" peak demand and flatten the daily use pattern; shaving regularly lowers demand and electricity bills. Those savings are often the catalyst for energy users, from businesses to utilities, to invest in storage projects. Smoothing peaks provides significant benefits across the grid, and reduced demand may change the resources being utilized to manage peak demand times. In addition to peak shaving and load shifting, energy storage has the ability to provide a range of other utility level services, including frequency regulation, voltage control and other ancillary services. Lastly, investments in battery storage at the distribution utility scale may also be an economically viable alternative to distribution system "wires" upgrades for reliability, also called "non-wire" alternatives.

RANGE OF STORAGE CUSTOMERS & BENEFITS

In early committee discussions, with the complexities inherent to the energy industry and the various perspectives possible, it was important to specify the benefit and to whom it would serve. Customers may be divided into the categories of residential, commercial, communities, industry and even utilities, from the perspective of the regional and national grid. Additionally, storage may benefit a single customer, a localized group of customers, the distribution system, and even the transmission system and energy markets, or all at the same time. Determining where benefits are realized is important. Is the benefit in the form of congestion management or simply directing traffic on the grid so electricity moves freely and equally? Does an individual residence, business or industry (often called "behind the meter") benefit? A transmission and distribution benefit is also possible. There can be varying benefits to any number of customers and energy markets when the use of storage is optimized, which is important to recognize when discussing the value of energy storage.

There can be varying benefits to any number of customers and energy markets when the use of storage is optimized…

INCENTIVE LANDSCAPE

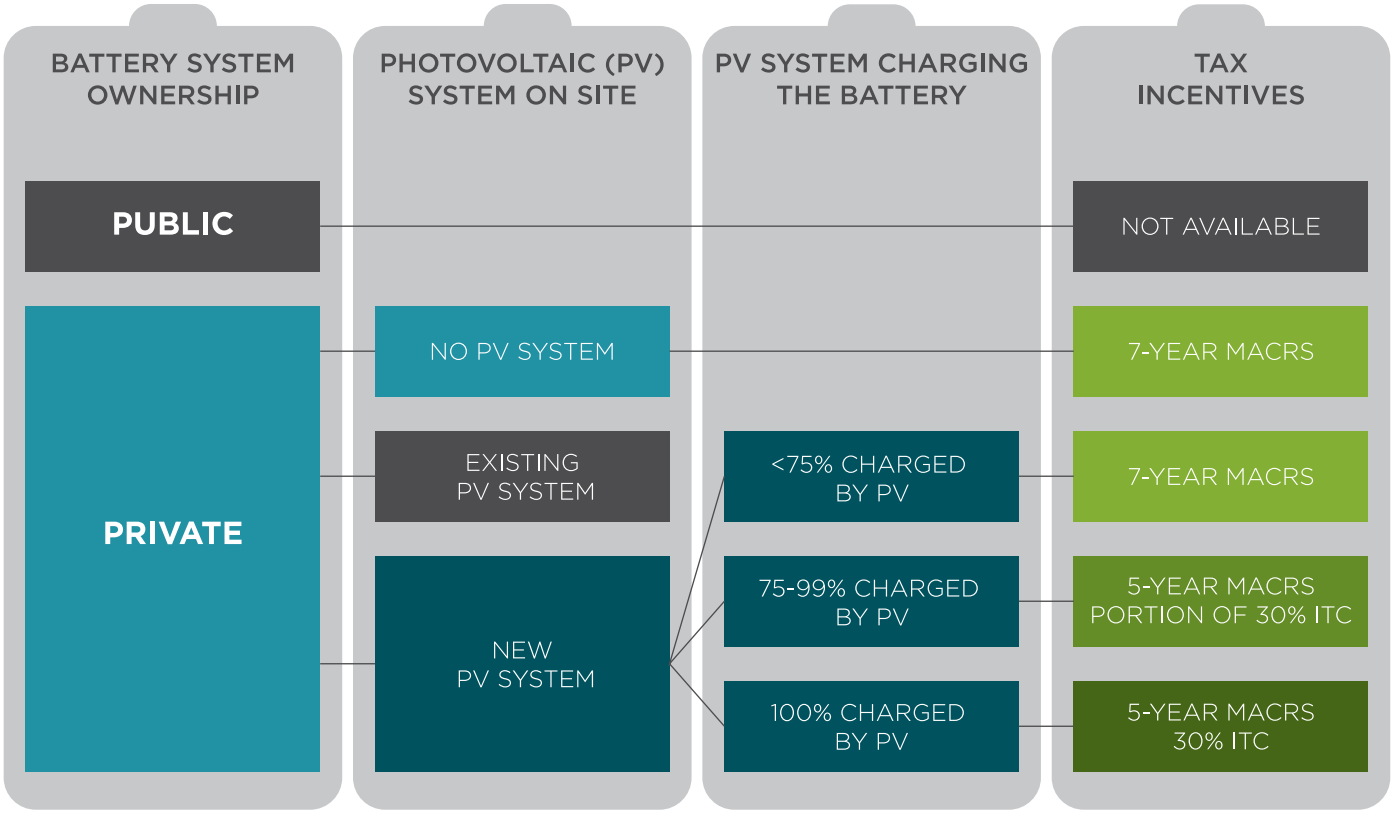
On a federal level, energy storage systems can be included in a portion of the 30 percent investment tax credit (ITC) if they are charged by renewable energy at least 75 percent of the time[4]. That 30 percent lowers annually to 10 percent starting in 2022 and beyond. If a project is 100 percent renewable-energy charged, the project is eligible for the full 30 percent credit.

Another federal incentive available to energy storage projects owned by a commercial business is eligibility for a modified accelerated cost recovery system (MACRS). This incentive means a 5- or 7-year depreciation schedule, which equates to approximately 20 to 21 percent lower cost of capital.

The full extent of the benefit to include the ITC and MACRS depends on whether or not the energy storage system is paired with a renewable energy source and how much of the system is charged by the renewable energy. The project remains eligible for a benefit if the storage is a stand-alone asset, but it should be noted that ownership is not tied to these types of incentives. For those seeking the benefits of storage but not the burden of developing, owning and operating it, private industry has the potential to bear that burden and establish power purchase agreements allowing the market to take over and create another avenue to assist with growth. With these federal benefits scheduled to shrink in the coming years, an effort to establish a separate, dedicated tax incentive is ongoing at the federal level according to the Energy Storage Association[5].

At the state level, there is a wide range of energy storage specific policies and incentives across the country, and a growing number of states have decided to encourage storage adoption. New York set storage targets of 1,500 MW by 2025 and 3,000 MW by 2030. New York has also committed nearly $400 million in incentives for energy storage systems[6]. Maryland announced the start of the Energy Storage Income Tax Credit Program that reserved up to $750,000 to eligible residential and commercial taxpayers that installed energy storage. California gives a rebate up to $400 per kilowatt-hour to homeowners who want to install a home battery[7]. Regardless of the policy or chosen path, each state has to decide how it wants to approach energy storage; and, if acting, encouraging storage adoption and accelerating the opportunity to achieve those benefits is a goal worth pursuing.

FEDERAL TAX INCENTIVES FOR ENERGY STORAGE SYSTEMS



SOURCE: www.nrel.gov/docs/fy18osti/70384.pdf

RECOMMENDATIONS

Open discussion and collaboration within the storage committee resulted in dialogue that was both educational and constructive in determining recommendations on how Iowa should prepare for and embrace energy storage. The committee emphasized the importance of all technology or forms of energy storage, and this action plan maintains that belief. By remaining technology neutral, the market will evolve naturally and eventually position the various applications to utilize the most applicable and cost-effective approach.

THROUGH DEEPER ANALYSIS, IDENTIFY AND REMOVE KEY BARRIERS TO STORAGE EXPANSION

The actual monetary value, as well as the many value streams of energy storage, is difficult to capture. The costs and benefits potentially span the entire electrical system and cannot easily or simply be calculated. That complexity and an evolving process to analyze the benefits to the grid, utility, end user and ratepayer make it a challenge to simply calculate the cost-benefit analysis of installing storage because a significant portion of the benefits are projected or estimated.

Calculating the costs of storage projects is a more straightforward process and starts with evaluating capital costs and expected maintenance. Reduced peak capacity is another major benefit of storage that can be calculated. However, other benefits that are more difficult to calculate include, but are not limited to, the value of enhanced resiliency, transmission and distribution deferral, energy price reduction, distributed energy resources integration, ancillary service cost reduction and generator cost reduction[8]. Benefits will continue to evolve as storage becomes more vastly utilized across all sectors of the energy industry.

The committee discussed placing a dollar value on the benefits of storage but noted the above complexities and variety of storage applications would make it difficult. However, the committee clearly recognized the existing potential value. Acknowledging the potential now and taking the necessary steps to begin to identify and address barriers will better prepare Iowa for its energy future. A recurring theme of storage committee discussions includes existing barriers and issues needing resolved. With the technological and policy complexities surrounding the storage discussion, it became clear that all barriers to implementation needed to be accounted for and realized first. Once accomplished, the necessary steps can be taken to adjust, update or remove barriers to allow for a streamlined path to energy storage adoption in Iowa.

Acknowledging the potential now and taking the necessary steps to begin to identify and address barriers will better prepare Iowa for its energy future.

Recommendation: IEDA should fund a study to evaluate potential benefits, as well as identify barriers, to expand the storage industry and the application of that storage in Iowa. Additionally, where possible, available information on Iowa's current and past storage pilot projects should be included for public education and awareness. With this study, appropriate and decisive decisions can be formed to produce the desired energy and economic benefits.

ENCOURAGE AND SUPPORT STORAGE PILOT PROJECTS TO LEARN OPERATIONAL AND FINANCIAL GAPS

During storage committee discussions, and amongst the limited members involved in a previous storage project, one sentiment shared was the wealth of knowledge and experience gained executing a project from project inception to execution to operation. The experiences may be equipment related, data related, neither or both. In one instance, a project underestimated the temperature requirements of a storage unit and didn't build in significant resources to cool the equipment, so adjustments and upgrades were necessary. Learning a new system and how to optimize equipment to its full capacity and benefit remove the guess work and inherent risk of starting something new.

Recommendation: IEDA's Energy Office will grant special consideration to proposed projects requesting funding that include an energy storage element and will encourage the Iowa Energy Center to take a similar position. This will lay the ground work for more storage pilot projects, and in the process, those operational and financial gaps can be filled and valuable experiences gained.

GLEAN BEST PRACTICES THROUGH COLLABORATION WITH MIDWESTERN STATES, NATIONAL STORAGE EXPERTS AND IOWA'S COLLEGES AND UNIVERSITIES

With a national electric grid that connects states to its bordering neighbors, energy produced in Iowa is not always contained within the borders and vice versa. As technologies advance and Iowa becomes more interconnected, electricity and the grid are no exception. Iowa needs to maintain open communication with neighboring states to ensure resources aren't duplicative and are utilized to maximum capacity for both sides of the border.

Midcontinent Independent System Operator (MISO), which consists of 15 states and operates the transmission system in the middle of the country, and ITC, the largest independent electricity transmission company in the country, were both represented on the storage committee and provided valuable insight into the transmission world and the grid.

Collaborative discussion led to the observation that of the 15 Midwest storage projects totaling 580 MW currently in the MISO queue to be built in the coming years, zero is planned to occur in Iowa. Due to a Federal Energy Regulatory Commission initiative, regional demand and increased interest in storage in recent years, MISO convened an energy storage task force of subject matter experts in 2017 to start discussing how to best prepare for the challenges and benefits of storage.

Recommendation: IEDA will continue to collaborate with utilities, Iowa's colleges and universities, stakeholders and regional partners such as MISO and the Midwest Governors Association, to maintain an open dialogue on how best to prepare for storage in this evolving market. Furthermore, to keep a pulse on developments at the national level, IEDA will maintain its information sharing and relationships formed with the Energy Storage Association, Clean Energy States Alliance, National Governors Association and National Association of State Energy Officials. Whether storage is best served at the grid level, smaller scale residential and community level, or a combination of both, is still to be determined; IEDA is committed to continued dialogue with industry stakeholders to discover the best use of the technology for all Iowans. In the meantime, IEDA will maintain open communication with its neighboring states and the ongoing stakeholders.

REALIZE THE JOB AND ECONOMIC BENEFITS OF STORAGE IN IOWA

When the Iowa Wind Energy Association began in 2008, the potential for job growth and anticipated economic benefit was a vision and a possibility for the future. Fast-forward to 2019, and Iowa's energy production portfolio consists of 37 percent[9] wind generation, and the wind industry supports 8,000 jobs in Iowa annually. Although it cannot be guaranteed energy storage will be as equally transformational as wind energy, Iowa can initiate the necessary conversations now to ensure the energy industry in the state is poised and ready to capture the potential economic benefits as they are presented.

As it stands now, Iowa is reportedly home to eight battery manufacturing companies employing a total of 177 Iowans with future growth expected to increase by 350 as manufacturing expansion announcements are released[10]. As the market expands to meet the demand of new technologies, Iowa needs to remain an attractive destination for startups and companies alike.

Iowa lacks the raw materials needed to economically construct the now popular lithium ion batteries, which presents a challenge to the state to become a leading manufacturer of the technology. However, it is important to recognize the direct and indirect job needs as the storage industry expands across the country.

Keeping the cost of energy low is a great start and a huge selling point for economic development in the state. The potential for more industry jobs can evolve into secondary economic benefits and beyond, which leads to continued economic growth that benefits the entire state.

Recommendation: Policymakers should feel encouraged to advance supportive storage specific policy to further attract and grow the industry to Iowa. As policy advances, leaders must ensure storage costs are allocated fairly to avoid a shift in costs. State policymakers should also monitor Congressional actions in the event dedicated tax incentive measures are established at the federal level. If dedicated federal storage tax incentives are established, Iowa should consider offering a complementary state incentive like its solar tax incentives.

Additionally, and as mentioned earlier, the Iowa Energy Office and the Iowa Energy Center should give special attention to funding storage projects to assist in the acceleration of storage adoption in Iowa. That encouragement and support will increase the development of storage projects, which will correlate to a rise in direct and indirect jobs to support the growth.

UPDATE BUILDING CODES, STANDARDS AND REGULATIONS FOR ACCEPTANCE OF STORAGE

The potential for codes, standards and regulations to restrict progress exists due to the pace at which technology is advancing. This has the potential to cause a more cumbersome process that can unintentionally slow implementation. Upon further evaluation, if it is determined that a process can be simplified or updated to more appropriately address regulatory concerns, collaboration should be encouraged. This methodology supports continual improvement to streamline processes and accommodate the pace of business. The first step in improvement is to identify barriers. By removing or updating the existing language, Iowa can create a supportive energy storage advancement environment.

Recommendation: As the governing body over utility regulations, the Iowa Utilities Board (IUB) is comprised of industry experts that can work with IEDA to ensure the proper storage policy is in place. IEDA should encourage the collaboration of the Iowa Department of Public Safety and other industry stakeholders to place visibility on the building codes, standards and regulations that are restricting the evolution and advancement of storage. Adequate consumer protections must be maintained, and if compliance is still justified, it can be confirmed. However, if opportunities for improvement exist, new processes can be identified.

RESILIENCY BENEFITS OF ENERGY STORAGE

Batteries and energy storage can play an enormous role providing energy resilience to first responders, storm shelters and other critical infrastructure when power is lost. In those emergency situations, pairing storage with renewable energy resources increases resiliency that allows a facility to continue to operate at some capacity until traditional power is restored.

Natural disasters occur and inclement weather is to be expected with Iowa's changing seasons. Internal combustion generators served as a temporary solution in the past and remain an option for many. However, those generators require fuel to maintain power. When storage is paired with renewable energy, everything needed to continue operating a facility in some capacity is already onsite or accessible. Iowa police or fire stations will be prepared to serve and help community members in need until power is restored and beyond. An example is the utility-scale energy storage system constructed and installed in Sterling, Massachusetts[11]. In 2016, the town of Sterling and its municipal utility began operating a 2-megawatt, 3.9 megawatt-hour battery storage system that is paired with solar and provides 12 days of backup power to the town's first responders. With a project payback of seven years, it is not only economical but also provides resilience making the community stronger in the process.

A 3.9 megawatt-hour battery storage system paired with solar can provide 12 days of backup power to the town's first responders.

Recommendation: IEDA should continue working with industry stakeholders to further investigate and communicate the resiliency benefits of energy storage. Natural disasters and severe weather will always be a threat, and by adding storage, Iowa communities will be better prepared. First responders will have the power required to assist those in need during times of hardship.

ENERGY STORAGE PAIRED WITH EV CHARGING STATIONS AND OTHER INFRASTRUCTURE

As EVs continue to rise in popularity, the demand for public and private charging stations will continue to trend upward. The high energy demand these charging stations require, depending on the level of charger, could add restrictive demand charges, as well as additional stress on the grid, both of which are major barriers to developing feasible charging station economic models. Storage and renewables plus storage could help alleviate the need for expensive infrastructure improvements that locations might need to continue to buildout and expand EV infrastructure.

IEDA released an EV report in February 2019 titled *Charging Forward: Iowa's Opportunities for Electric Vehicle Infrastructure Support*. The report elaborates on the increasing trend of EVs and encourages pilot projects that utilize energy storage due to its ability to lower the cost of power by reducing peak loads. These types of synergies in the industry are becoming more common as electrification continues to evolve.

Additionally, many EV batteries connected to the grid combined with advances in blockchain technology offer a real opportunity for distributed storage. At some point soon, the aggregate number of EV battery MWh may represent the majority of storage in Iowa.

Recommendation: IEDA and the Iowa Department of Transportation should continue to encourage the addition of storage for its peak shaving capabilities when further developing and expanding future EV infrastructure. Charging stations paired with storage pilot projects could provide operational data and real-world economics to understand the potential benefits of storage as it relates to EV infrastructure and implementation challenges.

ENSURE UPDATED SAFETY STANDARDS AND TRAINING FOR FIRST RESPONDERS

Outdated or duplicative safety measures add cost to a project, which makes them harder to initiate. The intent is not to sacrifice safety to save on project costs, but by initiating the conversation and re-evaluating the criteria, updates to the process may be possible. Improvements could help remove some existing barriers. In some cases, new technologies allow for new efficiencies or added capabilities with the same safety requirements. The goal of the conversations is to identify new resources that could help achieve Iowa's full potential and economic benefit.

Recommendation: IEDA will facilitate discussions with applicable stakeholders to evaluate the possibility of policy updates and the training needed by first responders and other safety professionals to handle these new technologies. The intent of these discussions is to keep an open dialogue between the public and private sector, allowing economic development to avoid unnecessary barriers, while maintaining the required safety procedures for the good of all Iowans.

CASE STUDIES

MAHARISHI UNIVERSITY OF MANAGEMENT SOLAR + STORAGE

Located in Fairfield, Iowa, at the Maharishi University of Management (MUM) sits Iowa's largest solar plus storage installation. The 1.1 megawatt (MW) solar array occupies five acres of land and produces 1/3 of the campus's electricity while utilizing advanced active tracking technology to follow the sun's path across the sky, which increases the array's production of power by as much as 15-20 percent. This technology is also paired with a 1.05 megawatt-hour (MWh) vanadium flow battery energy storage system (ESS). This ESS allows MUM to manage how much power they use from the grid and can in turn pull from the system's batteries during times of peak usage throughout the day and year when energy costs are highest.

By utilizing stored power during times of 'peak demand,' MUM is projected to lower its energy bill by 11 percent during the initial payback period and by over 30 percent once the project has been purchased from the initial investor. Actual dollar savings equate to $38,000 initially and $105,000 when owned outright. The addition of battery storage allows MUM to perform peak shaving, which decreases demand charges of about 30 percent of the university's bill.

These savings were a major contributor in project return on investment. This project was privately funded and is providing power to MUM through a power purchase agreement.

MiENERGY RESIDENTIAL STORAGE

MiEnergy Cooperative, which serves electricity to northeastern Iowa and southeastern Minnesota, recently launched a pilot project to test the benefits of battery storage. Two 16 kilowatt-hour smart battery storage systems are already up and running at the homes of Iowa members with plans for two 10 kilowatt-hour units to be commissioned in early 2019.

The co-op wants to gain a better understanding of battery technology on a small scale, like a residential home. The pilot will test four configurations: a grid-connected home with a generator backup; a grid-connected home with a solar backup; a grid-only connected home; and a home that is nearly 100 percent powered by solar with a grid backup.

The batteries will be tested for use as a tool for energy management. For example, during peak energy times the home would run off the battery system and be totally off grid to reduce peak demand. MiEnergy receives a bill each month for wholesale power from its provider, and peak demand charges are one of the components that make up the bill. The co-op's rate structure is based off wholesale power costs. Being able to seamlessly switch a home's electric source from the grid to a battery and back could help the cooperative manage electricity during peak energy periods. Managing the energy peaks to reduce peak demand charges can help keep rates for its members affordable. As a bonus, the battery could provide backup power during power outages.

The pilot will last five years after which the co-op hopes it is able to answer many questions, including optimal charging and discharging times for the batteries and the ability of batteries to offset residential and commercial energy peaks.

MIDAMERICAN ENERGY UTILITY SCALE STORAGE

In late December 2018, MidAmerican Energy Company began operating a pilot project utility-scale battery storage system.

An energy storage system enables a utility to store electricity for later use.

The battery project provides 4 MW-hours of storage capacity and can supply 1 MW of power for up to four hours. 1 MW is enough electricity to power about 900 average Iowa homes.

The lithium-iron phosphate battery system is housed in two truck-sized steel containers at a MidAmerican Energy substation in Knoxville.

"This innovative project will help us learn how best to use an energy storage system, and how it can serve our customers in the future," said Mike Fehr, MidAmerican Energy vice president of resource development. "Energy storage has the potential to allow us to retain energy when customer demand is low and release it during peak usage times. That would give us new options to manage peak loads, enhance overall reliability and help keep electric costs low and affordable for our customers."

Large-scale energy storage has the potential to provide several benefits, including:

- Flattening peaks and valleys of electric generation by enabling energy companies to generate and store electricity at times of low demand and release it when demand is high.
- Reducing the operating time of peaking generators, which generally run only when there is a high demand and are a relatively expensive form of generation.
- Enhancing renewable energy's reliability by storing energy produced when wind speeds and sun exposure are high and using it later.
- Improving power quality and prolonging transformer life.

"Energy storage is still in the development stages, and the economic feasibility on a larger scale is being assessed; however, prices are trending downward," Fehr said. "MidAmerican Energy wants first-hand experience with the technology, so we're positioned to quickly and efficiently add it to our system in ways that benefit our customers when the price is right."

SUMMARY

When the wind doesn't blow and the sun doesn't shine, storage can be part of the solution to maintain cost-effective renewable energy as the industry evolves. Energy storage translates these intermittent resources for maximum dispatchable benefit. The cost savings from storage, along with Iowa's low cost of energy, makes Iowa attractive to the private sector. These benefits produce jobs in Iowa and helps promote a prosperous economy.

Storage has a broad range of services that are possible from an individual user's benefit to overall grid health. Storage allows energy use by ratepayers, both residential and commercial alike, to maintain a flatter, less volatile load curve. A flatter, more predictable load curve reduces and sometimes eliminates peak demand and peak demand charges; it is cheaper for the user, the utility and ultimately the grid, because it places less stress and load on the grid lowering overall operational costs. Less stress eliminates the need to expand or reinforce the grid to accommodate an increase in capacity.

With the electrification of America, the energy industry is going through an evolution it hasn't seen since the creation of the national grid in the 1920s. Storage as a tool can assist in that evolution, and each state must determine how it chooses to introduce, and in some cases support storage, so the benefits are captured for the good of each state.

Although storage is often co-located with renewable energy due to its cost effectiveness and synergies, it is not required to see the benefits of storage. This report was written to spark conversation and discussion on how Iowa should best prepare for this new technology. With the committee recommendations and case studies shared, IEDA and the Iowa Energy Office are eager to help facilitate that conversation as Iowa continues to collaborate locally, grow sustainably and lead nationally.

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* IUB was as an observer of this process and not an active participant due to its regulatory nature.

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