A Bright Future:
A 10 Year Solar Deployment Plan for Utah

UTAH CLEAN ENERGY

SALT LAKE CITY

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INTRODUCTION

Red Hills Renewable Park: The 104 megawatt DC power plant, Utah's first utility-scale solar farm, was completed in late 2015. More than a gigawatt of large scale solar projects are expected to come online in Utah by the end of 2017.

Utah has overcome multiple barriers to solar adoption and has experienced significant solar market growth. Utah, formerly a nascent market, must now address challenges associated with increased solar market penetration. Over the last ten years, the market for rooftop solar in Utah has grown rapidly. In 2006 there were just 76 rooftop solar installations in the state, comprising 100 kilowatts—a striking comparison to a projected 140 megawatts of rooftop solar by the end of 2016. Utah's utility-scale solar market has also experienced notable growth; the first utility-scale solar project went online in December 2015, and more than a gigawatt of large scale projects are scheduled to come online by the end of 2017. Thanks to marked growth in both the rooftop and the utility-scale market, Utah now ranks 16th in the country for installed solar capacity[1].

A Bright Future: 10 Year Solar Deployment Plan for Utah is rooted in years of ongoing collaborative stakeholder engagement related to solar market development. *Powering Our Future—Solar Salt Lake Implementation Plan* was published in 2010 with support from the U.S. Department of Energy Solar America Cities initiative. *Powering Our Future* was a first-of-its-kind tool to help elected officials, government agencies, and affiliated partners identify and adopt proven strategies for transforming Utah's solar market. Six years later, many of the strategies identified in Powering Our Future have been implemented and many market barriers have been overcome.

Rooftop Solar in Utah: As the cost of solar declines, Utah's rooftop solar market continues to grow.

Utah's challenge for the future is to ensure continued market growth, improved market certainty for the solar industry, and fairness for consumers and utilities. The solar industry, regulators, and utilities must work together to address new topic areas related to emerging solar technologies and prepare for the continued evolution of the solar market. The 10 Year Solar Deployment Plan for Utah provides a clear path to overcome these challenges and guide the development of a sustainable and robust solar market across Utah.

The Wasatch Solar Team is an established and ongoing working partnership of representatives from government and non-government organizations, led by Salt Lake City and Utah Clean Energy, a 501(c)3 non-profit organization. *A Bright Future, A 10 Year Solar Deployment Plan for Utah* has been developed by Utah Clean Energy to outline strategies to achieve the Wasatch Solar Team's goals as a part of the Solar Market Pathways initiative.

1. SEIA. (2016, Sep. 9). Solar Spotlight: Utah www.seia.org/state-solar-policy/utah-solar

Approach

The Solar Deployment Plan was created based on input solicited from numerous stakeholders representing all facets of the clean energy industry, including solar companies, utilities, local and state government representatives, legislators, financiers, and nongovernmental organizations through workshops and one-on-one meetings. Through this stakeholder engagement process, the Wasatch Solar Team identified key topics which are of particular interest to stakeholders, as well as specific barriers which limit the continued growth of the solar industry. Using a scoring matrix, the Wasatch Solar Team prioritized barriers and solutions into near-term and long-term strategies based on the potential impact to the solar market, technical feasibility, political feasibility, and expected timeline for implementation. The Wasatch Solar Team then synthesized the contents of the ranked list of barriers and solutions into the following five key topic areas.

Solar Markets & Access – The solar market is experiencing significant growth, but not all Utahns are able to access solar energy. In order to ensure that all Utahns who want access to solar have affordable choices, it will be necessary to limit unnecessary restrictions on rooftop solar, expand financing mechanisms for the purchase of solar, develop alternative options for those unable to put solar on their roof, and develop programs to ensure that low-income families have access to solar.

Permitting – There is not a standardized, statewide approach to local solar permitting processes, and unpredictable or inconsistent rules from jurisdiction to jurisdiction ultimately result in higher costs for solar consumers. Although several Utah jurisdictions have adopted model solar permitting procedures, many local governments have not yet adopted best practices for solar permitting, resulting in hurdles for potential solar customers.

Interconnection – As solar market penetration increases and new technologies advance, interconnection rules must keep pace. Utah's interconnection standards were last revised in 2010, and since then national guidelines for interconnecting solar installations have evolved. The primary purpose of interconnection rules is to ensure that distributed generation projects are connected to the grid safely and do not pose a threat to grid reliability. New technologies have the potential to alleviate concerns about connecting high penetrations of rooftop solar to the grid, and embracing these technologies is critical to keep costs low for all utility customers in the long-term. All the while, it is important that the interconnection process remains transparent and efficient for both solar customers and the utility.

Utility Regulatory Model – The electric utility business is fundamentally changing. The cost of rooftop solar has fallen dramatically and both customers and utilities are now active participants in today's electric grid. It is critical that we plan for a future where customer-deployed resources are widespread and seek strategies for their integration that embrace customer choice, maximize benefits, and keep costs low for all customers.

Solar, Storage, and Resiliency – Solar has undergone dramatic price declines and the cost of battery storage has begun to fall commensurately. Solar combined with storage can both help manage day-to-day energy usage and provide robust backup power. As prices continue to fall, battery storage is poised to become an important part of the future energy market. By providing opportunities for Utahns to learn about battery storage and integrating battery storage into emergency planning processes we can move Utah towards a more resilient energy future.

CHAPTER 1: SOLAR MARKETS & ACCESS

Goal: All Utahns who want access to solar have affordable choices

Background

The solar energy market is experiencing exponential growth, but not everyone has access to solar. State rules and regulations, a shortage of financing options, and lack of suitable roof space limit universal consumer access. Utah currently has an A-rated net metering policy[2] which allows Utah residents and businesses to receive credit for solar energy produced on their own rooftops. Over the last ten years, the market for rooftop solar in Utah has grown rapidly. In 2006 there were just 76 rooftop solar installations in the state, comprising 100 kilowatts – a striking comparison to a projected 140 megawatts of solar by the end of 2016. Although swift declines in the cost of rooftop solar have increased the affordability of solar energy systems, many Utahns still don't have the opportunity to purchase solar energy.

Issues

1. Unnecessary restrictions on rooftop solar

Some Utahns have to contend with restrictions limiting their right to install solar. There is no federal law addressing the right to access solar, and Utah's State solar access law does not adequately protect Utahns' right to install solar on their own homes. Home Owner's Associations or historic districts may restrict or

[2] Freeing the Grid. freeingthegrid.org/#state-grades/utah

even prohibit solar installations for any reason, and may impose restrictions on solar installations that negatively impact the cost or performance of the system.

2. Shortage of available financing options

Historically, most customer-owned rooftop solar systems have been purchased with upfront funds.[3] Just like when purchasing a new car, some families and businesses do not have access to the upfront capital needed to purchase a solar installation. Financing and leasing models for solar are available, but relatively high financing costs can erode the return on investment for solar customers. Although the cost of solar continues to fall, the Federal tax credit will begin to step down in value in 2019.

3. Lack of suitable roof space

Some Utah homes and businesses have rooftops that are not suitable for solar due to shading. Renters or residents of condo and apartment buildings with shared roof space are also excluded from the rooftop solar market. Additionally, large energy users (like warehouses or data centers) who want to use green energy often do not have sufficient roof space to generate enough onsite solar energy to meet their goals, and rate structures allowing them to purchase electricity from an off-site renewable source are limited.

4. Low-income access to solar

Low- and moderate-income Utahns have much to gain from access to the solar market, but are unlikely to be able to afford the upfront purchase of a solar installation. Low-income communities are most at risk for economic and health related crises due to extreme weather events, health impacts from poor air quality, heat waves, and rising energy costs. While an average household spends 3.5% of their household income on heating and cooling bills, low-income households spend twice as much — an average of 7%.[4] Utah families who fall below 50% of the federal poverty level in Utah spend an astonishing 20% or more of income on energy.[5] 12.7% of Utahns live below the poverty level, and nearly a third of households in Utah do not have enough cash or savings to weather a loss of income and survive at the poverty level for three months.[6] The challenges facing low-income communities are daunting, which is why it is critical to develop solutions that expand low-income access to solar without placing additional financial burdens on these communities.

Solutions

In order to ensure that all Utahns who wish to access solar have affordable choices available to them, it is important to remove unnecessary restrictions on rooftop solar, develop additional financing mechanisms for the purchase of solar, develop alternative options for those who are unable to put solar on their roof, and expand access to solar for low- and moderate-income Utahns.

1. Remove unnecessary restrictions on rooftop solar

Home Owners Associations (HOA) and historic district rules commonly restrict a residents' ability to install solar. HOA covenants and zoning rules serve an important purpose ensuring the quality and value of their communities, but it is possible to achieve this goal while also allowing reasonably sited solar installations. HOA boards and historic preservation boards must be educated about the technical aspects of solar, including array size, orientation, tilt, and shading issues. HOAs can also explore opportunities to save on utility bills

by installing solar on common buildings, like gate houses and clubhouses. HOA residents who would like to install solar can approach their HOA boards with resources about rooftop solar and model covenants are needed to help HOAs implement standardized solar-friendly rules.

Utah's Solar Access Law[7] enables local governments to adopt rules that prohibit HOAs and other entities from restricting a citizen's ability to install solar. However, the law only applies to new HOAs or those that are renewing their covenants. Improving Utah's Solar Access Law to allow reasonably sited solar installations within all HOA communities and historic districts will provide solar access for homeowners within these communities.

2. Develop additional financing mechanisms for the purchase of solar

Most Utah solar customers purchase their solar installation using upfront funds, and those who do utilize financing typically rely on a Home Equity Line of Credit (HELOC), an option only available to those with equity in their homes. Property Assessed Clean Energy (PACE) can provide low-cost financing for Utah homes and businesses. PACE is a long-term financing option for building upgrades that reduce energy, save water, and produce renewable energy. Through PACE, upfront capital for a project is provided by a local government or third party lender and the property owner repays the debt through yearly assessments on the property as part of the property tax bill. Utah has an active PACE program for commercial buildings, but has yet to extend this financing mechanism to residential properties. Residential PACE would help Utah residents access upfront capital for installing solar, save money on energy bills, and increase the value of their property.

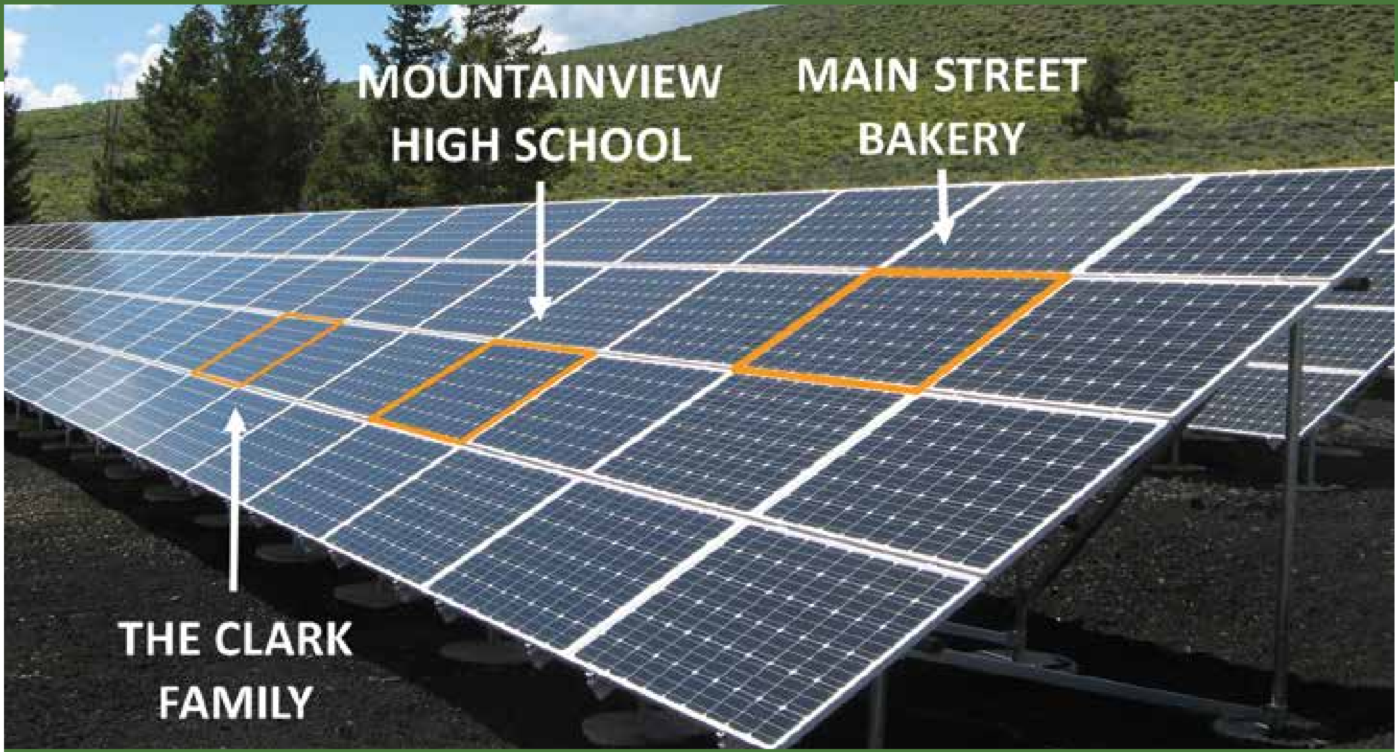
[3] Feldman, D. & Bolinger, M. (2016, May). Emerging Opportunities and Challenges in Financing Solar. www.nrel.gov/docs/fy16osti/65638.pdf

[4] Drehobl, A. & Ross, L. (2016, April). Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities. aceee.org/research-report/u1602

[5] Boyce, D. & Wirfs-Brock, J. (2016, May). High Utility Costs Force Hard Decisions for the Poor. insideenergy.org/2016/05/08/high-utility-costs-force-hard-decisions-for-the-poor

[6] Community Action Partnership of Utah. (2014). Annual Report. caputah.org/images/annual-reports/2014_Annual_Report.pdf

[7] Utah Code Title 10 Chapter 9a Part 6 Section 610: Restrictions for solar and other energy devices. The land use authority may refuse to approve or renew any plat, subdivision plan, or dedication of any street or other ground, if deed restrictions, covenants, or similar binding agreements running with the land for the lots or parcels covered by the plat or subdivision prohibit or have the effect of prohibiting reasonably sited and designed solar collectors, clotheslines, or other energy devices based on renewable resources from being installed on buildings erected on lots or parcels covered by the plat or subdivision.



Community shared solar projects allow Utah residents or businesses who are unable to install solar on their own roof to purchase a share of solar energy from a large solar project at a remote location.

Implementing residential PACE in Utah will require enabling legislation. Once enabled, lenders, contractors, local governments, and other stakeholders will need to work together to set up appropriate program administration structures for residential PACE and educate and spread awareness of residential PACE in Utah.

In the meantime, it is important to make information about the most affordable ways to purchase solar readily available to help consumers weigh their options. As financing options become more numerous and sophisticated, it is critical to ensure that consumers have appropriate information and tools to make well-informed decisions.

3. Develop alternative options for those who are unable to put solar on their roof

For Utahns who are unable to install solar on their own roofs, community shared solar projects offer access to off-site solar energy. Community shared solar projects allow utility customers to purchase a share of solar energy from a large solar project at a remote location, regardless of whether they own their home or have suitable roof space for solar. Community shared solar projects can be built at lower cost than rooftop solar, thanks to economies of scale, and can also be designed to offer additional benefits for the utility system as a whole. For example, community shared solar projects can be located at a specific point on the utility grid that is best suited to accommodate renewable energy, or integrated with demand response and storage to support increasing penetrations of solar resources.

Rocky Mountain Power, the largest electric utility in Utah, is currently developing a shared solar program, Subscriber Solar. The first 20 MW project is scheduled for completion in 2017. This type of program could be expanded, replicated by municipal utilities and rural electric coops, or modified to serve low-income customers. There are more than 50 municipal and co-op utilities across the state that serve approximately 20% of Utahns, three of which currently offer community shared solar projects.[8] Some municipal utilities in neighboring states have constructed community shared solar projects specifically to serve low-income customers.[9] Municipal utilities have opportunities to provide their customers with community shared solar installations and pilot projects will help utilities gain experience while expanding the availability of community shared solar to more Utahns. Municipal utilities could offer shared solar programs to their customers, or team up to construct joint community solar projects. Utilities developing shared solar projects should engage stakeholders throughout the project development process and complete a thorough review of best practices gleaned from successful community solar projects. (See *Resources*, page 8).

Utah's net metering policy allows solar customers to receive credits for producing solar energy on their own property. Residents of multi-family buildings are typically excluded from net metering because they either do not own the roof space or share the roof with other residents. Even when roof space is available, metering arrangements in multi-family buildings complicate the mechanics of a net metered installation. In order to fully take advantage of the roof space available in urban areas of Utah, we must review national best practices for installing solar on multi-family buildings and develop policy, technological, financing, or software solutions that will work in Utah.

Finally, businesses with large energy demands often want to access renewable energy through green tariff options. Green tariffs allow utility customers to choose to purchase energy from a renewable resource of their choice, giving customers additional options above and beyond a community shared solar program. Utah currently has two green tariff options. The first, Schedule 32,[10] has not been utilized due to the complexity and administrative costs of the program. A second option was approved in 2016: Schedule 34.[9] It will be important to monitor and modify these programs to ensure that they are meeting the objectives of the State of Utah and the needs of the business community to meet their growing demand for clean and renewable energy.

4. Build capacity to expand low-income access to solar

In order to expand low- and moderate-income access to solar, energy industry and policy leaders must gain a deeper understanding of challenges facing these communities by partnering with organizations that serve low-income communities. Shared projects will build community capacity to work collaboratively in venues and forums where community-level decision-making occurs and improve long-term program design and policy advocacy efforts. Together, we must develop strategies to ensure community resources are aligned with the areas of most need. Community solar designed to serve low- income citizens is an option that has worked elsewhere and should be explored in Utah. Further, local jurisdictions should consider developing loan or incentive programs for low-income communities or modifying existing financing and loan products to expand their practicality for the purposes of installing solar. For example, modifications to an existing loan for home energy improvements administered by Salt Lake County and the Community Development Corporation of Utah might increase use of the loan for solar projects.

[8] Logan City Community Solar & Solar Rate: www.loganutah.org/government/departments/light_and_power/solar/community_solar.php
St. George & Dixie Escalante Electric SunSmart: www.sgsunsmart.com/index.htm

[9] The San Miguel Power Association offers participation in a community solar program as one of the utility's Income Qualified programs www.smpa.com/content/iq-programs
Grand Valley Power Association offers a community solar program for low-income customers www.solarelectricpower.org/media/378380/solarops-case-study-grand-valley-power-low-income-community-solar-program.pdf

[10] Rocky Mountain Power Rate schedule information available at www.rockymountainpower.net/about/rar/uri.html

Resources

Homeowners Association Solar Policies:

- ***A Beautiful Day in the Neighborhood*, by The Solar Foundation**
  http://www.thesolarfoundation.org/a-beautiful-day-in-the-neighborhood-encouraging-solar-development-through-community-association-policies-and-processes
  A guidebook for architectural review committees and association boards of directors. Presents recommendations to help HOAs craft rules that will allow solar development while protecting the quality and value of the communities they govern.

- ***Salt Lake City Historic District's Rules for Governing Solar,* Salt Lake City**
  http://Salt Lake City Historic District's Rules for Governing Solar
  Salt Lake City's local historic districts take allow solar installations while still preserving the history and character of historic buildings. Guidelines for solar installations are described in Chapter 7.6.

Financing:

- ***PACE Nation*** *http://www.pacenation.us/residential-pace/*
  PACE Nation provides information about PACE programs across the country including resources for residential PACE programs.

- ***Best Practice Guidelines for Residential PACE Financing Programs*, U.S. Department of Energy**
  http://Best Practice Guidelines for Residential PACE Financing Programs
  In July 2016 the U.S. Department of Energy issued draft best practice guidelines for residential PACE Financing Programs. DOE gathered input and comments on the proposed guidelines.

Community Shared Solar:

- ***A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development,* National Renewable Energy Laboratory** *http://www.nrel.gov/docs/fy12osti/54570.pdf*
  A guide for community organizers, government officials, utility managers, and solar energy advocates who are interested in developing community shared solar programs.

- ***Community Solar Hub,* Clean Energy Collective** *http://www.communitysolarhub.com*
  The Community Solar Hub offers toolkits and resources to develop community shared projects and a map of community solar projects across the country.

- ***Model Rules for Shared Renewable Energy Programs*, Interstate Renewable Energy Council**
  http://www.irecusa.org/publications/model-rules-for-shared-renewable-energy-programs/
  IREC's model rules provide guiding principles and core components for community shared solar programs.

- ***Shared Renewable Energy for Low- to Moderate-Income Consumers: Policy Guidelines and Model Provisions,* Interstate Renewable Energy Council** *http://www.irecusa.org/publications/shared-renewable-energy-for-low-to-moderate-income-consumers-policy-guidelines-and-model-provisions/*
  This guide provides information and tools to support the adoption and implementation of shared renewables programs specifically designed for low-income customers.

- ***Coalition for Community Solar Access*** *http://www.communitysolaraccess.org*
  The Coalition for Community Solar Access is a business-led trade organization that works to expand access to community shared solar and open new markets to shared solar.

CHAPTER 2: PERMITTING

Goal: Reduce costs by streamlining and standardizing permitting

Background

Local city and county jurisdictions are the gatekeepers to solar energy for residents: every solar installation requires a building permit, and obtaining that permit can be a walk in the park or a tangle of red tape. Solar installers working along the Wasatch front must be familiar with dozens of individual city and county permitting processes and regulations. Unpredictable and inconsistent rules ultimately lead to higher costs and longer wait times for customers. Currently there is not a standardized, statewide approach to local solar permitting processes, ordinances, procedures, and regulations but there are best practices that should be replicated across the state.

Issues

Utah has made some progress toward streamlining and standardizing the solar permitting process, beginning with the Wasatch Solar Challenge (supported by the U.S. Department of Energy SunShot initiative). Through this initiative, Salt Lake City and Utah Clean Energy developed a Solar Permitting Toolbox[11] in 2013 to help local governments implement streamlined permitting. Leveraging the Solar Permitting Toolbox, some local jurisdictions have adopted an expedited solar PV permit, offer over-the-counter solar permits, or are able to review and approve solar permits quickly. However, the best practices and resources in the Solar Permitting Toolbox have not been widely adopted, and the permitting process can still be a significant hurdle for potential solar customers. Common remaining barriers include the following:

- Long wait times for permit review and approval;
- Multiple unnecessary inspections required;
- Burdensome submission processes; and
- High permitting fees.

Poor permitting practices increase the time and expense associated with completing a solar installation. In extreme cases, local permitting processes can deter installers from working in certain communities or make installing solar in certain jurisdictions prohibitively costly.

[11] Solar Simplified Solar Permitting Toolbox. solarsimplified.org/permitting/solar-permitting-resources-for-permitting-officials-local-governments

Solutions

Local jurisdictions have the opportunity to cut red tape, save taxpayer money, spur their local economy, and save time for building officials, installers, and homeowners by streamlining their solar permitting processes and adopting best practices. Local jurisdictions should become familiar with and share the following best practices:

- Utilize the solar permitting toolbox, www.solarsimplified.org
- Adopt the model expedited solar permit, www.solarsimplified.org
- Eliminate unnecessary multiple reviews or inspections; and
- Adopt an affordable fee schedule that is commensurate with the streamlined solar permit process.

In an effort to improve their solar permitting processes, several local jurisdictions have taken steps to streamline and simplify the process. Park City and Summit County have temporarily waived permitting fees and Summit County offers over-the-counter permitting. Salt Lake City has implemented an online portal which allows installers to apply for a permit online and track the status of their permit. Championing the efforts of local governments who have already taken steps to improve their solar permitting process will increase awareness and adoption of best practices. By sharing best practices through peer-to-peer exchanges, local governments can learn how to save time and money for their building officials and residents alike by adopting key permitting best practices.

Resources:

- *Model Solar Permit for Utah,* ***Solar Simplified***
  http://www.solarsimplified.org/permitting/solar-permitting-resources-for-permitting-officials-local-governments/model-solar-permit-for-utah
  The Solar ABCs expedited solar permit, adapted with Utah-specific information about wind and snow loading, is already in use in Park City and Summit County. Summit County offers over the counter permit processing and qualified installations can typically receive permits on the spot. Salt Lake City, Park City, and Summit County have made information about the solar permitting process available on their websites. The following are highlights from the Summit County expedited process:
  - Process is designed to cover majority of residential installations
  - Offers resolution steps for installations that do not fit the expedited process criteria
  - Required information is clearly defined
  - Describes criteria required to be eligible to skip extra review, i.e. if there is a 3 foot perimeter it does not require fire service review
  - Includes example diagrams for required drawings
- *Suggested Permit Fee Schedule,* ***Solar Simplified***
  http://www.solarsimplified.org/permitting/solar-permitting-resources-for-permitting-officials-local-governments/sample-permitting-fee-schedule
  The suggested solar permitting fee schedule allows local governments to recover the cost of reviewing and inspecting standard solar projects, while also creating a fair and balanced fee schedule for both residents and local governments.
- *Solar Permitting Best Practices Checklist*, ***Solar Simplified***
  http://www.solarsimplified.org/permitting/solar-permitting-resources-for-permitting-officials-local-governments/solar-permitting-best-practices
  A list of best practices for solar gleaned from nationally-accepted best practices developed and vetted by solar installers, building officials:
  U.S. Department of Energy SunShot Initiative *http://www.eere.energy.gov/solarchallenge*
  Project Permit *http://www.projectpermit.org*
  The Vote Solar Initiative *http://votesolar.org*
  The Interstate Renewable Energy Council *http://www.irecusa.org*
  Solar ABCs *http://www.solarabcs.org/*
  Wasatch Solar Challenge Team *http://utahcleanenergy.org/what-we-do/create-clean-energy/item/91-solar-simplified*

CHAPTER 3: INTERCONNECTION

Goal: Reduce costs associated with interconnection process

Background:

The falling cost of solar technology has spurred the growth of the rooftop solar market. Although rooftop solar installations are primarily designed to provide onsite power for a home or business, a connection to the grid facilitates the distribution of excess energy to neighboring homes and buildings when the rooftop solar owner is producing more energy than they are using. As battery storage and solar inverter technologies evolve, rooftop solar installations that are connected to the grid will be able to provide additional services to help to maintain grid stability and reduce operating costs. Rooftop solar installations and other onsite energy resources must meet interconnection requirements, which outline technical and contractual requirements for connecting to the grid, to ensure they are connected safely and do not compromise the reliability of the grid.

The Utah Olympic Oval has 791 kilowatts of solar mounted on parking canopies. The array produces enough power to meet 20% of the ice rink's refrigeration needs.
Photo credit: Intermountain Wind & Solar

From 2007 to 2010, Utah's Public Service Commission undertook a comprehensive review and revision of the state's Interconnection Standards. At the onset of the effort, Utah scored poorly on a national scorecard for interconnection standards. Following efforts led by Salt Lake City and Utah Clean Energy, the Interstate Renewable Energy Council, and numerous stakeholders, the Utah Public Service Commission adopted improved standards in April 2010.[12] Although Utah's interconnection standards represented best practices at the time, the rooftop solar market has grown significantly. Since 2010, national guidelines for interconnecting solar installations have evolved to address the growing interest in renewables and accommodate increasing penetration of solar on the grid.

[12] Utah's interconnection rules can be found in Utah Administrative Code Rule R746-312. Electrical Interconnection www.rules.utah.gov/publicat/code/r746/r746-312.htm

[13] Rocky Mountain Power. (2016, June 29). Rocky Mountain Power's Customer Owned Generation and Net Metering Report. www.psc.state.ut.us/utilities/electric/elecindx/2016/1603528indx.html

Issues

1. Rapid growth of Utah's solar market

Utah's rooftop solar market has experienced significant growth, on average doubling yearly for 10 years running. As a result, the number of Utahns requesting interconnection approval has grown from about 200 applications in 2010 to more than 10,000 applications in 2016.[13] The rapid growth of rooftop solar requires the utility to review and approve more applications and install more bi-directional meters each year, and the utility must be able to recover the cost of providing this service. It is challenging for the utility to complete timely interconnection reviews as the volume of applications continues to grow rapidly, and solar installers report increased delays and unpredictable timelines associated with the interconnection process for projects of all varieties.

2. Increasing solar penetration complicates project screening

The amount of rooftop or community solar that can be safely accommodated on the grid varies by location. Factors that influence the safe interconnection of distributed solar include the age of distribution infrastructure at the proposed site, usage needs and patterns of customers in the area, and the amount of distributed solar that is already connected to the grid nearby. Screening requirements are used to efficiently identify projects that have the potential to undermine grid reliability. In some cases, a solar project can proceed safely by making infrastructure improvements.

As solar penetration increases in Utah, proposed projects are more likely to trigger requirements for grid upgrades. At the same time, solar technology is evolving to facilitate better integration with the grid, grid management practices are changing to accommodate increasing penetrations of renewable resources, and industry understanding of the technical basis for infrastructure improvements is becoming more robust.

3. Asymmetrical information about grid conditions

Distribution grid infrastructure upgrades add cost and complexity to a solar project, and when the process for completing improvements is not clear it can cause confusion, delays, and frustration. Installers and solar customers in Utah do not have advance information about the distribution system at a proposed point of interconnection and therefore cannot know whether infrastructure improvements will be required before they initiate the interconnection process. When grid improvements are required, installers need to obtain location-specific information about the distribution system at the proposed project site from the utility. If installers are able to obtain this information quickly and easily, they can avoid submitting applications for projects that require expensive upgrades and are unlikely to be completed, design systems correctly at the start of the interconnection process, and accurately estimate the length of the interconnection review process. The current process for obtaining necessary information about a proposed point of interconnection from the utility is not well understood and frequently results in project delays.

Solutions

National interconnection standards and best practices have evolved since Utah's standards were last updated in 2010 (year). Through a collaborative working group process, the utility, the solar industry and Utah's regulators can identify opportunities to improve the interconnection process for both developers and utilities, accommodate expected higher penetrations of solar, and maintain system safety and reliability.

1. Streamline the interconnection process

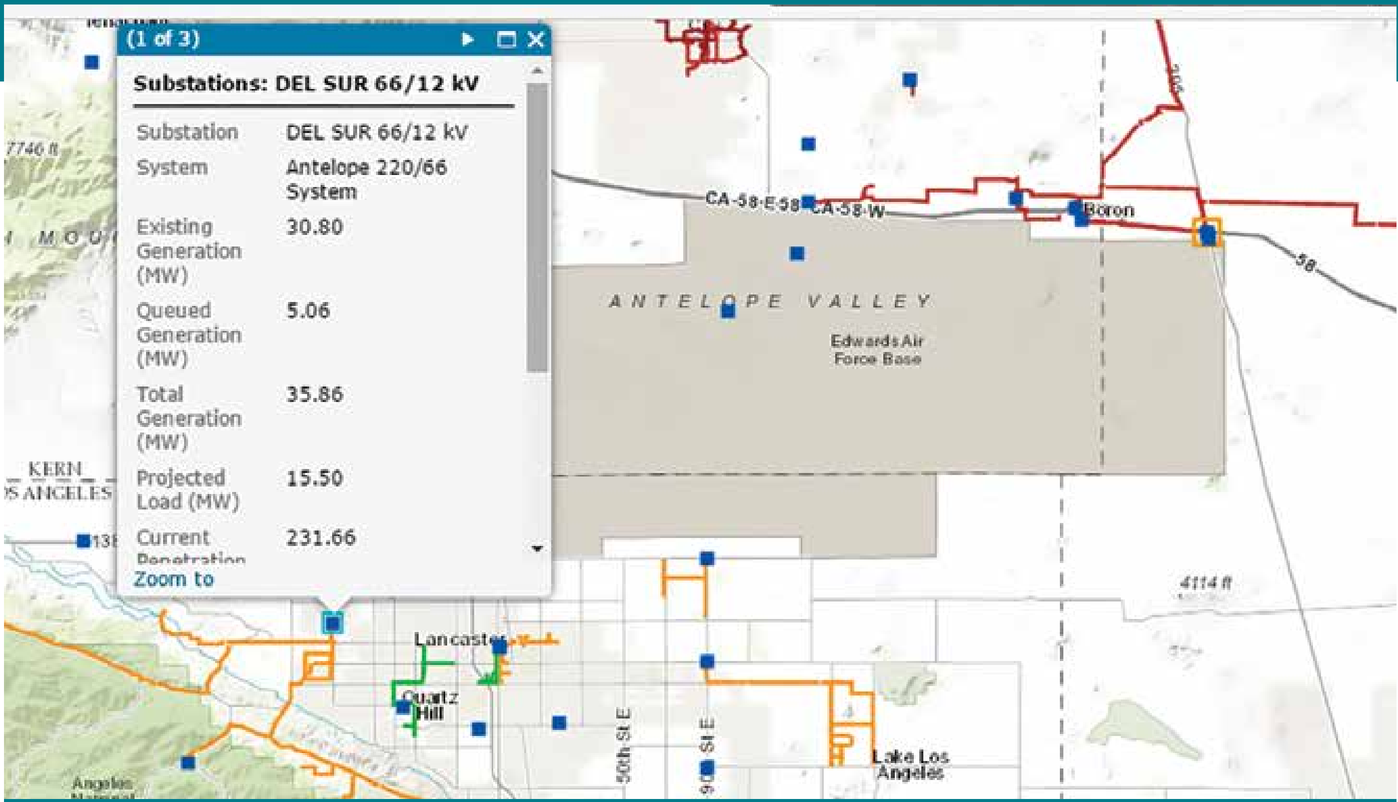
In light of the rapid growth of the solar market, which is expected to continue, it is critical to explore opportunities to increase the speed and efficiency of the interconnection application process so that it is easier for the utility to meet existing deadlines. Improvements that streamline the interconnection process and avoid costly delays include the following:

- Transparent information about interconnection requirements and the application process
- Electronic submittal, signature, and tracking process for interconnection applications;
- Application fees that are sufficient to ensure the utility is adequately staffed; and
- Improved dispute resolution process for minor complaints or disputes about technical require ments.

2. Monitor new developments in interconnection standards

It's important to understand the capabilities of emerging onsite renewable energy resources and technologies, and to facilitate their safe interconnection to the grid. As technical understanding of safe and reliable integration evolves, Utah's regulators, the utility, and the solar industry should engage in active dialogue about technical questions related to interconnection and solar integration. The threshold values which are used to screen projects will need to be reevaluated periodically in order to keep up with emerging best practices. Regulators, the utility and the solar industry should collaborate and engage in shared learning to anticipate and implement improved technology and grid management practices. This will ensure that new solar projects are able to connect to the grid safely while maximizing potential grid benefits and keeping costs low.

The utility, the solar industry, and solar customers all benefit from an efficient screening process. When necessary, a supplemental review process allows projects that do not meet initial screening requirements to undergo a secondary review to determine whether they can safely interconnect, rather than proceeding immediately to a full



Utility distribution system maps, like this one published by Southern California Edison, make information about the distribution system available to solar customers and developers. See Resources for additional information.

study, which is time-consuming and expensive. A supplemental review provides an efficient and cost-effective route to resolve safety and reliability concerns. Utah's existing procedures contain a supplemental review process that is not clearly defined. Updating Utah's supplemental review process to provide more detail on the technical review requirements will increase the transparency and efficiency of this process.

3. Improve transparency of local grid conditions

A transparent process that allows solar installers and customers to get information from the utility in a timely manner will minimize costs and delays associated with the interconnection process. To achieve this, the utility and solar industry can collaborate to identify what pieces of information solar installers need to determine whether infrastructure improvements will be required at a given project location. From there, installers need access to the tools, information, or guidance from the utility to design projects that meet utility requirements.

Some utilities have developed distribution system maps which make detailed information about the entire distribution system widely available. Although maps take time and resources to develop, they can help utilities in the long run by eliminating the need for developers to submit project-specific information requests to the utility.

Another solution is to allow solar installers to request an optional pre-application report before beginning the interconnection process. Pre-application reports have been adopted in several states and incorporated into the Federal Energy Regulatory Commission's Small Generator Interconnection Procedures (SGIP) and are considered useful by both solar installers and utilities. A pre-application report allows a solar installer to pay a small fee to obtain pre-existing data about a proposed point of interconnection and is designed to require limited effort from the utility.

Resources

- ***Model Interconnection Procedures*, Interstate Renewable Energy Council**
  http://www.irecusa.org/publications/model-interconnection-procedures
  IREC's Model Interconnection Procedures summarize best practices for safely and reliably connecting renewable energy systems to the utility grid.

- ***Pre-Application Report***
  http://www.ferc.gov/industries/electric/indus-act/gi/small-gen.asp
  - The Federal Energy Regulatory Commission (FERC) has incorporated a pre-application report requirement into Section 1.2 of its Small Generator Interconnection Procedures (SGIP) in 2013. *https://www.ferc.gov/industries/electric/indus-act/gi/small-gen.asp*
  - IREC's Model Interconnection Procedures include a pre-application report in Section II. *http://www.irecusa.org/publications/model-interconnection-procedures*

- ***Supplemental review***
  - The Federal Energy Regulatory Commission (FERC) Small Generator Interconnection Procedures (SGIP) describes a Supplemental Review process in Section 2.4. *http://www.ferc.gov/industries/electric/indus-act/gi/small-gen.asp*
  - IREC's Model Interconnection Procedures also include a supplemental review process in Section III.D. *http://www.irecusa.org/publications/model-interconnection-procedures*

- ***Distribution system maps***
  Southern California Edison's Distributed Energy Resource Interconnection Map (DERiM) makes information about the distribution grid available to customers and developers online. Developers can use this information to estimate the viability of a solar project in a given location.
  http://www.arcgis.com/home/webmap/viewer.html?webmap=e62dfa24128b4329bfc8b27c4526f6b7

CHAPTER 4: UTILITY BUSINESS MODEL & REGULATION

Goal: Transition the utility business model and regulation to align with increasing amounts of distributed generation, demand response, energy efficiency, and energy storage.

Background

The electric utility business is fundamentally changing. Widespread energy efficiency is lowering demand for electricity, slowing the need for new utility investments in large generating plants. New and constantly improving technologies allow homeowners and businesses to generate their own, cleaner electricity on-site, using a variety of distributed energy resources, including solar and battery storage. Distributed energy resources[14] across the electric grid are popular and cost-effective for many. In addition, smart appliances, like programmable thermostats for heating and cooling, remotely controlled lighting, and power control technologies, are changing the way the electric system operates. Thanks to these innovations, both customers and utilities are active participants in today's electric grid.

Planning for distributed energy resources and their integration into the grid will increase their usefulness and allow the electric system to operate optimally and cost-effectively. Some utilities and utility regulators are taking the time to understand the technical capabilities of distributed energy resources and plan for the potential benefits of widespread, customer-deployed resources. However, many utilities and states are reacting to the changing landscape by enacting reforms without evaluating how best to integrate customer-sited resources. This approach hinders the ability of utilities and customers to achieve the greatest benefits from distributed energy and to operate a cleaner, more dynamic electric system over the long term. This dilemma is best articulated by the Regulatory Assistance Project (RAP):

> *"The regulator's challenge in this time of transition is to support policies that use the legacy systems wisely while nurturing the evolution of the systems that will facilitate the transition to a far more efficient, environmentally benign transactive electricity sector.[15]"*

In order to ensure continued adoption of distributed energy resources, like rooftop solar, we must integrate our evolving understanding of the benefits of increased customer choices and ongoing technological advancements with the regulatory practices embedded in the traditional electric utility industry.

[14] Distributed energy resources can include solar PV and battery storage as well as advanced inverters, electric vehicles, power control technologies, and demand response.

[15] Linville, C., Shenot, J., & Lazar, J. (2013, Nov). "Designing Distributed Generation Tariffs Well." www.raponline.org/wp-content/uploads/2016/05/rap-linvillshenotlazar-faircompensation-2013-nov-27.pdf

Issues

1. The utility business model is not aligned with customer investment in distributed solar

The existing utility business model is a creature of the early 20th century when widespread access to electric power was new and expanding. Utilities are regulated monopolies that generate and transmit electricity to customers and earn a profit by investing in new power plants and receiving a return on that investment. Utilities recoup and earn a return on their capital investments through the retail sale of electricity. A utility's financial health is directly linked to its investments in new power plants and infrastructure and collection of their return on that investment through electricity sales. Thus, a reduction in energy consumption can directly impact a utility's profitability.

Customer investments in renewable energy or energy efficiency create a complicated problem for utilities, their shareholders, and regulators. Reduced energy consumption means the utility does not need to pay for costly new capital investments over the longer term. This means customers don't have to pay for these costly new investments, but it also means the utility loses out on its sole opportunity to realize profits under the current regulatory paradigm.

2. New technologies create new planning and operational opportunities

As distributed energy resources explode into the marketplace, more and more customers are taking control of their own energy resources and becoming active participants in the grid. New technologies and customer choices can bring long-term cost and operational benefits to the electric system, but only if utilities recognize their value and are rewarded for integrating these resources into the grid.

3. Customer-sited solar raises customer equity concerns

Over time, distributed solar will reduce a utility's costs by displacing or deferring investments in new power plants, distribution infrastructure, or transmission lines – saving all electricity customers money. On the other hand, when considering near term utility costs, increased distributed solar also reduces a utility's revenues because customers who install solar, just like energy efficient customers, ultimately purchase less electricity from the utility. As solar customers pay less toward a utility's revenues, it has the potential to put increased pressure on non-solar customers to pay for the costs the utility has already incurred (its "fixed costs"). Thus, one concern about rooftop solar is that as the amount of rooftop solar increases it may cause customer inequity issues.

Solutions

1. Align utility incentives with distributed solar growth

The traditional utility business model gives utilities an incentive to prevent customers from choosing to generate their own electricity in order to reduce their bills. In order to realize the operational and cost benefits of widespread distributed energy, it is necessary to evaluate the ongoing viability of this model. Utilities should not be reliant on capital investments and increased energy consumption to remain financially viable.

Rather than viewing distributed solar as a barrier to profits, utilities should be able to respond to, integrate, and facilitate new technology and customer choice into their business model. While this is a complicated and difficult project, the long-term benefits outweigh the challenges, and there are a number of models available for consideration:

- Revenue regulation or decoupling. A decoupling mechanism allows a utility to recover its costs independent of energy consumption. While decoupling may address a utility's cost recovery concerns, it does not necessarily give them a financial incentive to facilitate or encourage deployment of distributed energy resources.

- Performance-based incentives. Performance incentives go beyond allowing a utility to recover costs (as with decoupling) by creating financial incentives tied to specific performance metrics. For example, a performance incentive could be designed to reward the utility for reliable service, renewable deployment, energy efficiency, reduced greenhouse gas risk, reduced fuel risk and cost of service reductions.

- Broader electricity market changes. Broader market reforms could segment the vertically integrated utility industry or allow new market participants. While complicated, such reforms may make sense over the long term. For example, "energy services" providers could produce power for distribution providers who transport power and supply it to customers.

2. Understand the technical capabilities of distributed energy resources

Distributed energy resources can be integrated into our existing utility system in ways that benefit customers and the grid. To realize these benefits, it is critical that we create learning and information sharing opportunities to evaluate and understand the capabilities and technical issues associated with integrating high penetrations of distributed energy resources. Such opportunities occur at all levels of utility planning and operations, including in utility system planning, regional transmission planning, and reliability efforts.

- Improved distribution and transmission system planning. Of particular importance in maximizing beneficial use of distributed energy resources is reforming utility distribution system planning to be accessible, transparent, and oriented toward enhancing the value of distributed energy resources in grid operations. Rocky Mountain Power has begun to explore the value that solar and storage can provide to the grid with a pilot project that is designed to defer transmission upgrades.

- Interconnection and operability standards. As more distributed energy resources are installed, the grid must become smarter to accommodate these resources and to realize their full potential. Solar inverters, in their most basic form, convert DC power from solar panels to AC power so that usable electricity can be delivered to homes, businesses, and the grid. Modern "smart" inverters go a step further by providing voltage support to the grid, which supports reliable grid operation. Existing interconnection standards in most states prohibit inverters from performing these functions, but utilities in Hawaii, California, and Arizona have begun to modify their interconnection requirements to enable the capabilities and benefits that smart inverters can provide to the system. Further, as the cost of battery storage technology continues to fall, standards will need to be revised to address the safe interconnection of battery storage systems.

3. Set rates to facilitate smart growth of distributed solar and customer equity

While increased distributed generation has the potential to reduce grid costs for all customers over time, it is important to address how a utility recovers its fixed costs from customers in the near term. The solution is to design electricity rates appropriately, taking into consideration both short and long-term costs and benefits. In order to ensure that we realize the grid benefits of adding distributed solar to the grid, electricity rates should send accurate and actionable price signals to customers and reflect the long-term value of increased solar adoption.

While potentially more difficult than calculating the costs of the grid, considering and quantifying the broad grid benefits and risk mitigation potential of distributed generation is key to designing fair rates for all customers. If rates do not fairly value and compensate distributed generation, market growth will falter, the benefits of distributed energy resources will not be realized, and long-term utility costs will increase (and rates will rise). Rates should enable the long-term grid benefits of distributed energy resources and ensure fairness for all customers, with and without solar.


Photo credit: NREL

- Avoid solar-specific rates. Rate designs that apply only to distributed generation customers result in missed opportunities to engage all utility customers in efforts to reduce utility system costs, especially costs associated with system peaks.

- Send accurate price signals about the temporal and seasonal value of energy. Time-variable rates for all customers allow utilities to send price signals that more accurately reflect the temporal costs of energy usage. Price signals prompt customers to make better choices about how and when they use energy, and can result in load reductions of 10 to 35 percent and shift consumption to off-peak hours.[16] Time-varying pricing, rather than higher fixed charges or demand charges, can not only provide customers with the ability to manage their utility bills but also enable utilities to recover utility infrastructure costs.

- Expand distributed generation market access to promote equity. The distributed energy market is currently dominated by rooftop solar, so customers who do not own a home, do not have a suitable roof, or do not have the upfront capital to purchase a solar installation are unable to access the economic benefits of distributed generation. See Chapter 1, Solar Markets and Access.

[16] Lazar, J. (2016, Feb). Teaching the Duck to Fly. www.raponline.org/wp-content/uploads/2016/05/rap-lazar-teachingtheduck2-2016-feb-2.pdf

Resources

1. ***Smart Rate Design for a Smart Future,* Regulatory Assistance Project**
   Principles for modern rate design based on a review of technological developments driving the 21st century energy market.

2. ***On the Path to SunShot: Utility Regulatory a Business Model Reforms for Addressing the Financial Impacts of Distributed Solar on Utilities,* National Renewable Energy Laboratory**
   An analysis of potential rate reforms and their impact on the continued growth of the rooftop solar market.

3. ***Designing Distributed Generation Tariffs Well: Ensuring Fair Compensation in a Time of Transition,* Regulatory Assistance Project. January 2014.**
   An outline of regulatory options for addressing concerns associated with the increased penetration of distributed generation, including rate design options for regulators to consider and recommendations for implementing changes.

4. ***Revenue Regulation and Decoupling,* Regulatory Assistance Project. June 2011.**

Goal: Incorporate solar and storage for resiliency and emergency preparedness

Background

The growing frequency of extreme weather events and the very real threat of a significant earthquake in Utah[17] drives the need for resilient backup power systems. A majority of Utah's population resides in areas that are prone to the greatest hazards from an earthquake.[18] Solar panels can help manage day-to-day energy usage, but, when coupled with batteries, can also provide robust backup power in the event of grid outage. Solar and storage systems are versatile and scalable, and can be combined with traditional backup generators. This combination makes solar and storage an ideal solution for critical facilities that require uninterrupted power supply, such as hospitals, communication centers, radio stations, and community emergency shelters.

Issues

Battery storage technology is evolving rapidly and battery costs have fallen significantly, but several barriers slow the adoption of this technology in Utah markets.

1. Cost of storage

Battery storage costs have fallen by more than 50% since 2010[19], and are expected to fall another 50% by 2020.[20] Batteries can be used to save money on utility bills by providing an alternative source of energy during times of peak electricity usage, when utility prices are higher, and by reducing demand charges for commercial customers. Although commercial and industrial use of battery storage is already cost-effective in certain markets, the relatively low cost of utility electricity in Utah results in a long payback period for battery storage.

As is the case with solar, the upfront cost of battery storage may remain a barrier even when the return on investment is favorable. Options to access battery technology using lease structures or financing will reduce the upfront expense. There are state and federal tax incentives to reduce the upfront cost of solar energy systems, but there are not specific incentives for battery storage. Several private letter rulings indicate that energy storage technologies can qualify for the Federal renewable energy Investment Tax Credit (ITC) in certain cases, however the IRS has not issued an official revenue ruling on the topic.[21]

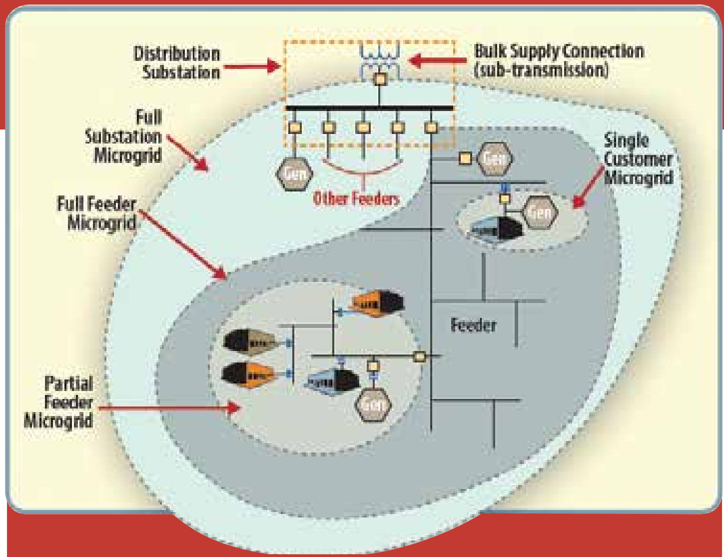
[17] U.S. Geological Survey. (2016, April). Earthquake Forecast for the Wasatch Front Region of the Intermountain West. https://pubs.usgs.gov/fs/2016/3019/fs20163019.pdf

[18] Be Ready Utah. Earthquake Preparedness. www.utah.gov/beready/earthquakePreparedness.html

[19] Moody's Investor Service. (2015, September 14). Declining battery prices could lead to commercial and industrial customer adoption in 3-5 years. www.moodys.com/research/Moodys-Declining-battery-prices-could-lead-to-commercial-and-industrial--PR_335274

[20] Lazard. (2015, November 17). Levelized Cost of Storage Analysis 1.0. www.lazard.com/perspective/levelized-cost-of-storage-analysis-10

[21] Martin, K. (2013, April). Project Finance Newswire. www.chadbourne.com/In_Other_news_Batteries-04-01-2013_projectfinance



Microgrids are energy systems which can isolate from the electric grid and operate as an independent grid to provide standalone power.
Photo credit: U.S. Department of Energy, The Role of Microgrids in Helping to Advance the Nation's Energy System. energy.gov/oe/services/technology-development/smart-grid/role-microgrids-helping-advance-nation-s-energy-system

2. Low consumer awareness about battery storage technology

Utahns value emergency preparedness and resiliency, and community conversations about readiness and disaster response are commonplace. Although Utah families and businesses are familiar with traditional sources of backup power, like generators, they are less familiar with solar and battery storage systems. The cost of battery storage has recently undergone significant declines and while solar is becoming commonplace in Utah, battery systems remain rare. Many facilities, especially those that provide critical services, currently rely solely on emergency generators for backup power.

Battery storage systems can serve many functions: to reduce electricity purchases from the utility and save money on utility bills, to isolate from the grid and operate as an independent microgrid, or to do both. Different types of battery backup systems require different components and configurations depending on the intended use of the system. Storage and inverter technologies are evolving rapidly and new products and brands are entering the market and competing to offer cheaper, more efficient, or simpler solutions.

The deployment of battery storage is on the rise, and new products like the Tesla Powerwall are creating interest in battery backup for homes and businesses. However, there is still a shortage of user-friendly information about the capabilities, limitations, cost, requirements, and intended purpose of different types of battery systems. Consumer Reports recently released a buying guide for solar energy,[22] but no such resource exists for battery storage. The complexity and novelty of solar and storage systems makes it difficult for the average consumer to evaluate battery backup options and find the information they need to make an informed decision.

3. Valuing resiliency

Furthermore, although there are clear benefits to having battery backup power, it is challenging to quantify the value of resiliency and emergency power afforded by a solar and storage system. In the event of a grid outage, reliable backup power can be used to provide critical services, maintain life support, ensure business continuity, and protect data. Unlike a traditional diesel or natural gas generator, battery storage can be used both to access economic savings on a day-to-day basis and to provide emergency backup power, and batteries can extend the life of a diesel or natural gas generator in the event of fuel shortages. Battery storage can even offer air quality and health benefits if sited such that the batteries supplant peaking power plants on poor air quality days.[23]

[22] Garskof, Josh. (2016, June 30). Shedding Light On Solar Power. www.consumerreports.org/energy-saving/shedding-light-on-solar-power

[23] Krieger, E. M., Casey, Joan A., & Shonkoff, S. B. C. A framework for siting and dispatch of emerging energy resources to realize environmental and health benefits: Case study on peaker power plant displacement. www.sciencedirect.com/science/article/pii/S0301421516302798

Although it is clear that resiliency benefits have value, the economic return on investment for solar and storage in Utah is currently derived only from avoided energy purchases. The value of clean, pollution-free, backup power is not quantified as part of the economic analysis. A variety of approaches have been used to quantify the value of resiliency, but more consensus is needed to develop a consistent approach for valuing these benefits.

4. Lack of information about the grid benefits of solar and storage

Battery storage, combined with energy efficiency, electric vehicles, smart grid technologies, and rooftop solar, has the potential to bring about a more reliable, flexible, and resilient energy grid and reduce costs associated with the operation of the distribution and transmission systems. As communities grow and existing infrastructure ages, utilities have used traditional planning processes to identify when they must replace outdated infrastructure or add generation resources to meet growing energy needs. Although costly, these investments are necessary to maintain the reliable electricity service Utahns count on. As the cost of battery storage continues to fall, utilities are exploring how new types of distributed generation and storage technologies can be used in place of traditional infrastructure investments to provide power during times of peak load on the grid, stabilize voltage, or provide other grid benefits. In many cases, storage can defer costly investments in new infrastructure. To realize the full potential of solar and storage, we must understand the grid services battery storage can offer and how to best incorporate assessments of these new technologies in traditional utility planning processes.

Solutions

1. Overcoming economic barriers

Over the last several years, the cost of solar has declined to the point where the price for long-term contracts for solar electricity is approaching the average market price of conventional power generation.[24] As battery technology advances and costs continue to fall, the value proposition for solar and storage systems will continue to improve.

In the short term, tax incentives can be used to incentivize accelerated adoption of battery storage. Utah's solar market has advanced thanks in part to a State tax incentive for installing solar, and a similar incentive for distributed storage could encourage the early adoption of battery storage. In late 2015 the U.S. Department of the Treasury and the Internal Revenue Service foreshadowed an interest in redefining the types of property that qualify for the renewable Investment Tax Credit (ITC), potentially to include battery storage. The IRS issued a request for comments on "whether property such as storage devices and power conditioning equipment may also be considered energy property."[25] If battery storage technology is deemed eligible for the ITC, the battery storage market is likely to experience significant growth.

[24] Fares, R. (2016, August 27). The Price of Solar is Dropping to Unprecedented Lows. blogs.scientificamerican.com/plugged-in/the-price-of-solar-is-declining-to-unprecedented-lows/

[25] IRS Notice 2015-70. Requests for Comments on Definitions of Section 48 Property. www.irs.gov/pub/irs-drop/n-15-70.pdf

EXPLORING THE VALUE OF BATTERY STORAGE

Utilities can help their customers' access affordable battery storage while simultaneously leveraging private investments in battery storage to increase grid resiliency. Win-win solutions like this can both reduce the economic barriers to battery storage and build a more resilient grid.

Green Mountain Power

A utility in Vermont has launched a pilot program that allows customers to lease batteries for their home or to receive bill credits to offset the purchase price of a battery. In exchange, customers with batteries allow the utility to access power from the battery during times of peak demand, which provides cost savings to all customers. In the event of a grid outage, participating customers can use the battery as a source of backup power. When the grid is operating normally, Green Mountain Power can leverage the private investments of battery customers to provide services that reduce costs for all customers.

Brooklyn-Queens Neighborhood Program

Con Edison, a New York utility, hopes to avoid a substation upgrade by incentivizing customers to take energy efficiency measures and install distributed generation amounting to 41 megawatts of capacity. The utility plans to complete an additional 11 megawatts of utility-scale projects, including energy storage. Compared to the $1.2 billion cost of the substation upgrade, the incentives will only cost the utility $200 million.

As is the case with solar, the upfront cost of battery storage will remain an economic barrier even as the cost continues to fall and payback periods decrease. Utilities can help their customers access affordable battery storage options without the upfront cost through leases or on-bill financing. Several utilities across the country provide incentives for customer-sited battery storage.

2. Provide opportunities to learn about solar and storage

A greater understanding of the potential resiliency benefits of solar and storage will help overcome the economic barriers. Over time, Utah consumers will become more familiar with solar and storage technology as it becomes a more common backup power solution. In the meantime, information sharing can help Utah homes and businesses understand the potential benefits of solar and storage and understand whether battery backup power makes sense for them.

Local governments, community planners, the solar industry, and emergency preparedness groups should partner to provide current information about solar and storage technologies, assessments of the costs and benefits, and case studies of solar and storage at work in the community. Case studies should focus not just on the day-to-day economic benefits of a solar and storage system, but also on the value of resilient backup power during an extended outage, air quality benefits from solar and storage, and the potential for solar and storage to mitigate the impacts of fuel shortages during an outage. Further exploration of these topics will help promote greater public understanding on the unquantifiable benefits of incorporating storage.

Photo credit: NREL

3. Incorporate solar and storage into existing emergency planning processes

Information about the resiliency benefits of solar and storage will help facility managers identify opportunities where solar and storage may be a cost-effective solution that also benefits resiliency efforts. Businesses installing solar and facilities managers should consider the benefits of incorporating storage and should evaluate solar and storage as a replacement for, or complement to, existing or planned gas generators. Local governments and community planners should be educated about the benefits of solar and storage and consider incorporating battery storage into existing emergency preparedness planning processes. State and local governments already engage in hazard mitigation planning to identify risks and vulnerabilities associated with natural disasters, and must have a hazard mitigation plan in place in order to receive non-emergency funding for mitigation projects from FEMA. Pre-disaster hazard mitigation plans must be updated every 5 years.

Local governments should identify solar and storage projects as an opportunity to mitigate the adverse effects of widespread power outages. This will allow local governments to evaluate the benefits of solar and storage alongside other mitigation strategies. Finally, customers who are not ready to install solar and storage today should investigate storage-ready solar installations. Those who have chosen solar components that are compatible with battery storage will be able retrofit their systems with lower costs and complexity.

4. Incorporate solar and storage into distribution and transmission planning

Utilities and regulators should explore the potential of solar and storage to defer costly investments in transmission and distribution networks, reduce costs for all customers, and enhance grid resiliency. Utility planning processes should include an analysis of solar and storage, among other non-traditional alternatives, to evaluate when storage is a more affordable solution to congestion or voltage problems than new transmission and distribution poles and wires. Utilities and regulators should work together to gain a robust understanding of the technical benefits of solar and storage, gain experience implementing storage projects, and design policies or rate structures which reward the addition of private storage resources in a way that also benefits the grid.

Rocky Mountain Power is currently considering a pilot solar and storage project that would use battery storage to resolve voltage issues on a transmission line. During peak summer months, the voltage on the transmission line threatens to fall below the required voltage standards. Storage technology can be used to defer or eliminate a capital investment in upgraded poles, wires, or sub-stations. This pilot project, and others like it, may provide valuable insights into the role that solar and storage will play in the future.

Resources

- *Solar and Storage for Energy and Resiliency, A guide for consideration,* ***by Utah Clean Energy.***
  http://utahcleanenergy.org/images/Solar_and_Storage_for_Energy_and_Resiliency_by_Utah_Clean_Energy_002.pdf
  Essential information about solar and storage and how it can enhance resiliency, including considerations for solar and storage or storage-ready systems, technical options and components of a solar and storage system, implementation models, and success stories.

- *Solar+Storage Project Checklist,* ***by Clean Energy Group.***
  http://www.cleanegroup.org/wp-content/uploads/Solar-Storage-Checklist.pdf
  A starting point for solar and storage and storage projects or storage-ready solar projects. This checklist outlines all the questions you will need to answer before implementing a solar and storage checklist and provides guidance to get started.

- *Resilient PV Retrofit and Storage Ready Guidelines,* ***by City University of New York's NY Solar Smart DG Hub.***
  https://nysolarmap.com/media/1655/dghubresiliencyretrofitfactsheet_8_8_16.pdf
  This factsheet provides guidance on retrofitting existing solar projects with energy storage. As the costs of battery storage continue to decline, adding storage to an existing solar system will become increasingly cost-effective. Develop your solar project such that it is ready to be retrofitted with storage in order to avoid additional cost and hassle.

- *Resilient Solar Photovoltaics (PV) Systems,* ***by City University of New York's NY Solar Smart DG Hub.***
  https://nysolarmap.com/media/1451/dechardwarefactsheet.pdf
  Learn more about the different hardware components of a solar and storage system. The factsheet also covers integrating a solar system with battery storage and other distributed generation assets like combined heat and power (CHP), diesel generators and other renewables (like wind).

- *Economic and Resiliency Impact of PV Systems,*
  by City University of New York's NY Solar Smart DG Hub
  https://nysolarmap.com/media/1636/economic-and-resiliency-impact-of-pv-and-storage.pdf
  This report explores the economic and resiliency benefits of solar and storage project by analyzing three critical infrastructure sites in New York City.

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