Planning for an Energy Resilient Future: Energy Project Models and Lessons Learned

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ABSTRACT

As the force and frequency of major natural disasters has increased, so has the federal, state, local, and tribal costs of recovery from these natural disasters. Therefore, it is important to invest in energy measures that can mitigate natural disasters and build resilient communities. There is a growing opportunity for energy technologies such as energy efficiency and renewable energy to play an integral role in resilience planning and implementation for state, local, and tribal governments.

Federal response towards disaster mitigation has increased. There are national interagency initiatives such as the Mitigation Framework Leadership Group (MitFLG) and federal funding opportunities that focus on pre-disaster mitigation efforts including U.S. Department of Energy (DOE) State Energy Program (SEP), Federal Emergency Management Agency (FEMA)'s new Building Resilient Infrastructure and Communities (BRIC) grant and Department of Housing and Urban Development (HUD)'s Community Development Block Grant (CDBG) Mitigation.

State, local, and tribal governments have expressed interest in utilizing federal and other funds available to mitigate against power outages and understand how to replicate successful projects. Through the collection of best practices and understanding the benefit-cost analysis (BCA) of these projects, stakeholders will have a greater sense of how energy efficiency and renewable energy with storage can be incorporated into the design and implementation of federal mitigation projects.

This paper lays out various federal funding opportunities, showcases innovative energy projects that integrate energy efficiency measures and renewable technology, and recommends steps for further federal, state, and local engagement opportunities to build stronger community preparedness and resiliency.

Introduction

The United States has sustained 258 weather and climate disasters since 1980 where overall damages and costs reached or exceeded $1 billion. Since the federal National Oceanic Atmospheric Administration (NOAA) has collected and tracked this data, the most devastating natural disaster related costs stem from 119 events occurring between 2010-2019, totaling over $802 billion in damages (NCEI 2020). For example, consider 2017, a year in which the US experienced Hurricanes Harvey, Maria, and Irma in addition to the Northern California wildfire causing in total over $300 billion in losses as demonstrated in Figure 1. The increase in natural disaster events, and consequently the increase in the number of lives lost and cost of damages, has elevated the importance of investing in mitigation strategies that can decrease the effects of natural disasters. As the force and frequency of major natural disasters has increased, so has the federal, state, local, and tribal costs of recovery from these natural disasters. Therefore, it is important to invest in energy measures and build resilient communities that can mitigate against natural disasters. There is a growing opportunity for energy technologies such as energy efficiency and renewable energy plus storage to play an integral role in resilience planning and implementation for state, local, and tribal governments.

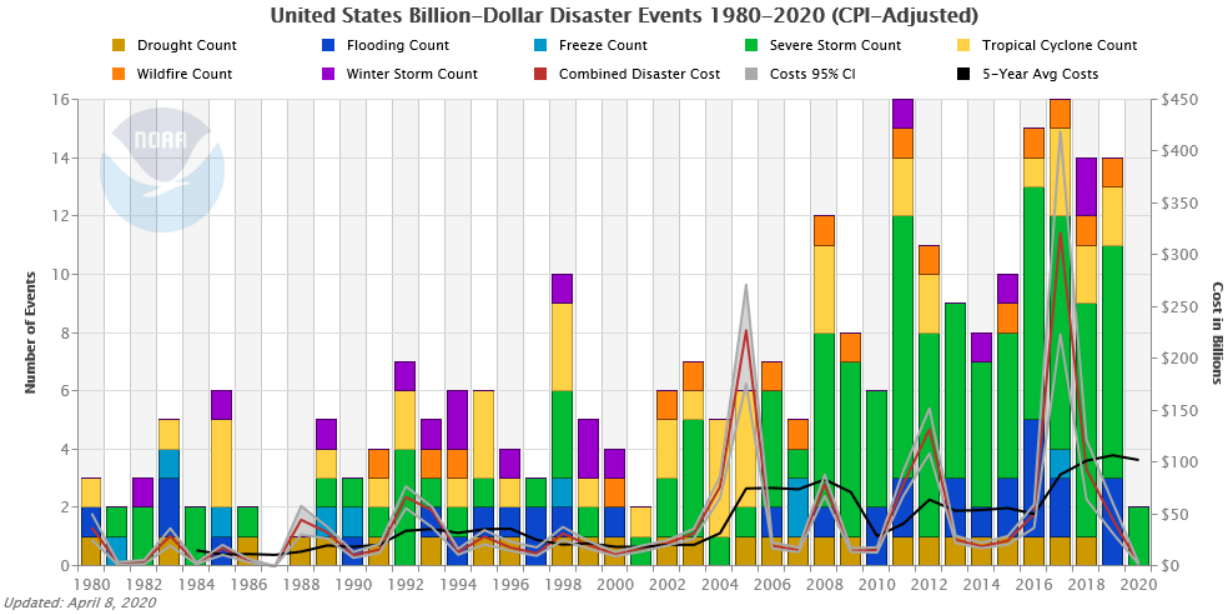

Figure 1 The total cost over the last 3 years (2017-2019) exceeds $460.0 billion — averaging $153.4 billion/year. The total cost over the last 5 years (2015-2019) exceeds $535.0 billion — averaging $107.1 billion/year. Costs from natural disasters have increased compared to the average. Source: NCEI 2020.

FEMA has defined mitigation as, "risk reduction to reduce the risk to life and property, which includes existing structures and future construction, in the pre and post-disaster environments" (FEMA 2020a). Additionally, FEMA funded a study by National Institute of Building Sciences published in 2017 that determined for every $1 spent on hazard mitigation, the nation can save $6 in future disaster costs (NIBS 2017). Furthermore, energy efficiency, renewable energy, and energy storage technologies have the potential to enhance traditional natural disaster mitigation measures, such as generators, while also serving to lower energy costs

and increase environmental impacts. These technologies have also received attention from stakeholders interested in reducing power outages and increasing energy resilience.

Energy efficiency improvements in buildings serve to reduce the amount of utility-purchased energy. Reducing the overall electricity demand of a building reduces the likelihood of demand spikes that can lead to outages. Demand reduction can also lessen the energy needed for facilities to maintain critical functions, such as lighting, during a grid outage (DOE 2019). When energy efficiency is paired with on-site generation and storage, the risk of a power outage is further reduced. Solar power along with energy storage can mitigate a power outage due to its islanding capabilities (NREL 2018).

Federal Funding and Disaster Mitigation

Stakeholders have the opportunity to invest in energy efficiency and renewable energy plus storage technologies by leveraging federal programs. While there are multiple programs in various federal agencies, this paper will focus on three: FEMA's Building Resilient Infrastructure and Communities (BRIC); U.S. Department of Housing and Urban Development (HUD)'s Community Development Block Grant Mitigation (CDBG-Mit); and U.S. Department of Energy (DOE)'s State Energy Program (SEP). In addition, federal agencies coordinate through FEMA's Mitigation Leadership Framework Group (MitFLG), which is focused on developing helpful mitigation resources to stakeholders.

Federal Emergency Management Agency

Building Resilient Infrastructure and Communities

On October 5, 2018, the Disaster Recovery Reform Act was signed into law; Section 1234 of the law authorized FEMA to develop a new pre-disaster mitigation program, Building Resilient Infrastructure and Communities (BRIC) (FEMA 2020b). This program will ultimately supersede FEMA's Pre-Disaster Mitigation Grants beginning in fiscal year 2020 and will establish a more reliable stream of funding by leveraging a 6% set-aside mechanism, based on annual disaster relief fund expenditures, to establish a new nationwide competitive mitigation grant program (FEMA 2019a). In the current 2019 grant cycle, FEMA's pre-disaster mitigation grant program has made available $250 million for states, tribal, territorial, and local governments to reduce overall risk to the population and structures from future natural disasters. It is estimated that annual funds will average $300M- $500M per year and will enable FEMA to support states and communities in undertaking new, innovative, and large infrastructure projects designed with capacity and capability building to withstand the risks of natural disasters. (FEMA 2019b).

Through BRIC, there is an opportunity to actively reshape disaster mitigation solutions by leveraging energy efficiency and renewable energy plus storage technologies. Throughout 2019, FEMA conducted an extensive series of stakeholder engagement outreach activities at all levels of government to inform the development of the BRIC program. The efforts included online crowd-sourcing, webinars, and various meeting platforms. In total, FEMA received 75 formal letters and approximately 5,000 comments, illustrating stakeholder interest in the new program. Notably, there was significantly increased interest from state energy offices.

As part of an interagency collaboration in November of 2019, FEMA co-hosted a two-part webinar series with the DOE's Weatherization and Intergovernmental Programs Office

(WIP) to inform state, local, tribal, and utility stakeholders on how to build resilience in the energy sector through innovative energy mitigation projects that incorporate energy efficiency, renewable energy and storage, and micro-grids (DOE 2019b). These webinars convened state hazard mitigation offices and state energy offices, and participants were encouraged to collaborate on projects that serve to build resilience in the energy sector.

Cross-cutting energy projects allow states the opportunity to leverage various federal resources to develop innovative disaster mitigation solutions. These engagements also support FEMA's Community Lifelines. A Community Lifeline is a framework that enables the continuous operation of government functions and critical business and is essential to human health and safety and economic security (FEMA 2020c). An example of a key priority is the Energy Lifeline, which is part of FEMA's Community Lifeline approach to designate and categorize sectors that need continuous operations during a disaster (FEMA 2020c). The Energy Lifeline includes essential elements such as the power grid, temporary power, and fuel. There are various measures to help protect these elements from disasters including energy efficiency, renewable energy and storage, which can assist in maintaining temporary power (FEMA 2019e). For example, FEMA's Public Assistance program, another FEMA program that incorporates mitigation measures, funded recovery efforts and upgrades to the New York University (NYU) Langone Medical Center. The successful completion of this project illustrates how FEMA utilizes the lifeline approach to mitigation.

2012 NYU Langone Medical Center Mitigation Project

On October 30, 2012, as a result of Hurricane Sandy, the NYU Langone Medical Center suffered severe flood damage (FEMA 2019c). High winds and heavy rain disrupted power to the facility and backup generators failed. Nearly 300 patients, including 45 critical care patients and 20 babies were evacuated to other area hospitals (FEMA 2019c). In December, FEMA's Public Assistance program provided nearly $150 million in funding to support the medical center. The University responded by developing and implementing a holistic, campus-wide mitigation strategy to minimize the impacts of similar, future events (FEMA 2019d). Some of the resulting projects included constructing a flood barrier to shield campus buildings, a new combined heat and power plant, and emergency generators, which enables the facility to be self-sufficient in the event of a utility power interruption and ensures uninterrupted medical treatment. These activities used mitigation funding to safeguard the lifelines pertaining to health and medical facilities as well as energy, and safety and security. This project is an example of both an innovative energy project that goes beyond the traditional back up generation solution and how the BRIC program has the potential to implement this level of innovation in the energy sector across several forms of disaster mitigation and FEMA lifelines to improve national resiliency.

U.S. Department of Housing and Urban Development

Since 1974, the U.S. Department of Housing and Urban Development (HUD) has administered the Community Development Block Grant (CDBG) program. The CDBG program provides federal grants to communities that enable resources and funds to address a wide range of unique community development needs (HUD 2020a). Historically, these funds are annually distributed to allow grantees (states, territories, cities, and counties) autonomy to develop viable communities and expand economic opportunities, principally for low- and moderate-income

persons.[1] However, with the rise of extreme weather events, CDBG has become a catalyst for investing in resilience measures in communities.

When needed, Congress can appropriate supplemental funding for disaster assistance from major disasters declared under the Stafford Act. These appropriations allow Congress to create grants such as Disaster Recovery grants (CDBG-DR) and more recently, Mitigation grants (CDBG-Mit), through the CDBG program. These funds are unique because unlike other recovery assistance programs administered through agencies such as FEMA that are permanently authorized, HUD's disaster assistance is authorized only on a need-basis at the discretion of Congress. HUD has administered disaster assistance since 1992 and the CDBG program has been utilized numerous times over the years to address natural disaster's impact on communities and infrastructure. For example, in 2014-2016 HUD held a national competition called the National Disaster Resilience Competition (CDBG-NDR) which supported funding for disaster recovery and long-term community resilience (HUD 2020b). While CDBG disaster assistance funds are flexible, they are only offered to eligible state, territory, local, and county entities that have a qualifying disaster in a specific year. In addition, while each CDBG program offers rules tailored to its program objectives, CDBG-DR and CDBG-Mit grants have a statutory focus to support vulnerable low-income communities and target the most impacted and distressed areas.[2]

Community Development Block Grant Disaster Recovery (CDBG-DR)

This HUD program has been utilized in various years to address large scale disasters in America. For example, CDBG-DR appropriations were used to assist New York City's recovery efforts after September 11th, 2001 and to assist the victims of Hurricanes Katrina, Rita, and Wilma in 2005 (HUD 2019a).

The allocation of CDBG-DR focuses on disaster relief, long term recovery, restoration of infrastructure and housing, and economic revitalization. Eligible activities for CDBG-DR are those that are able to demonstrate a logical connection between the impacts of the disaster and a contribution to the recovery of the community. For example, funds can be used to rebuild homes and infrastructure damaged by the disaster (HUD 2019a).[3] CDBG-DR can cover mitigation measures if it is part of the rebuilding efforts. For example, homes damaged from disasters can receive energy efficiency retrofits that meet green building standards. Green buildings are structures that, among other important benefits, make efficient use of energy and water. Green building standards are determined by the U.S. Green Building Council and include energy efficiency certifications such as Energy Star, LEED, Enterprise Green Communities and ICC-700 National Green Building Standard (HUD 2018). Since 2013, HUD has required all CDBG-DR grantees to use green building standards for all new construction or replacement of damaged residential buildings (HUD 2013).

On occasion, CDBG-DR funds can be specified to support wider mitigation efforts as seen in 2018 appropriations that required that out of $28 billion granted, no less than $12 billion be allocated for mitigation activities in states and jurisdictions that received CDBG-DR funds for disasters occurring in 2015, 2016, and 2017 (Congress 2018). HUD was able to allocate an additional $3.9 billion, bringing the amount available for mitigation to nearly $16 billion (HUD

[1] Tribal Nations receive separate funds called the Indian Community Development Block Grant (ICDBG) program.

[2] CDBG Regulations apply, unless modified by Federal Register Notice.

[3] For example: New construction, rehabilitation/reconstruction, single family or multifamily, owner or rental. Also includes road and bridge repair, water and wastewater facilities.

2020c). However, broader mitigation activity is better utilized through FEMA's mitigation programs or CDBG-Mit.

Community Development Block Grant Mitigation (CDBG-Mit)

This HUD program was announced in 2019, and it is the first mitigation-only focused CDBG program (HUD 2019b). HUD's mitigation funding is an important step from a reactive approach in the face of a disaster to a proactive one. As HUD's Federal Register notes, the funds, "represent a unique and significant opportunity for grantees… to carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses" (HUD 2019b).

Congress initially provided eligible grantees with guidelines and $6.8 billion in CDBG-Mit funds (HUD 2019b). Additional funds were authorized to support efforts in Puerto Rico and the U.S. Virgin Islands totaling $15.9 billion in CDBG-Mit funds to support 9 states, 2 territories and 5 local communities (HUD 2019c, 2020d).

To receive CDBG-Mit funds, grantees are required to develop and submit an action plan to HUD which details the proposed use of all funds. Some grantees have used this as an opportunity to invest in energy efficiency and renewable energy technologies. For CDBG-Mit funded projects, some grantees are applying HUD's required green building standards by incorporating renewable energy. The state of California's draft action plan reports that it intends to promote high quality, durable, and energy efficient construction methods in areas impacted by the 2017 fires. This includes utilizing California's mandated new building standards, "2019 Building Energy Efficiency Standards," that require all newly constructed homes to include solar photovoltaic systems, effective January 1, 2020 (HCD 2020). Many action plan drafts are undergoing public comments and are authorized for adjustment even after submission to HUD.

Both CDBG-DR and CDBG-Mit can play a role to increase energy efficiency and renewable energy investments to mitigate against power outages. Grantees are in the process of designing and planning various activities for these funds and many recognize the opportunity to apply innovative solutions to mitigate against natural disasters and strengthen community resilience overall. For example, adopting higher energy efficiency standards, deploying renewable energy and incorporating energy storage are suitable measures to maintain reliability. One of HUD's goals of CDBG-DR and CDBG-Mit is to set a nationwide standard to help guide state, territorial and local mitigation investments.

U.S. Department of Energy

State Energy Program

The U.S. Department of Energy's State Energy Program (SEP) provides annual formula grant funding and technical assistance to states, territories, and the District of Columbia to enhance energy security, advance state-led energy initiatives, and maximize the benefits of energy efficiency. The distribution of this funding is based on population and energy consumption.[4]

[4] Allocation of funds among the States: (i) One-third of the available funds is divided among the States equally; (ii) One-third of the available funds is divided on the basis of the population of the participating States as contained in the most recent reliable census data available from the Bureau of the Census, Department of Commerce, for all participating States at the time DOE needs to compute State formula shares; and (iii) One-third of the available funds is divided on the basis of the energy consumption of the participating States as contained in the most recent

SEP originated as the State Energy Conservation Program, which was enacted as part of the Energy Policy and Conservation Act of 1975 (P.L. 94-163). This legislation was the cornerstone of federal energy conservation and established programs to foster conservation in federal buildings and major industries throughout the states. SEP operates on a congressionally-appropriated annual budget of roughly $50 million (DOE 2019c). As part of the requirements to receive formula funding, states must have an energy emergency plan for an energy supply disruption that includes an implementation strategy for dealing with energy emergencies (10 CFR §420.13 (9)).

Additionally, SEP supports energy offices in energy emergency planning, disaster response, and recovery activities. Since 2015, states have invested over $30 million in SEP formula funding into energy emergency, resilience, and energy security activities.[5] The following are a few examples that showcase integrating energy efficiency and renewable energy technologies into disaster mitigation projects as well as examples of how state energy offices have partnered with, and empowered, local governments to develop energy emergency plans and projects:

Florida SunSmart Schools and Emergency Shelters

In 2010, the Florida Department of Agriculture and Consumer Services' Office of Energy invested $9.8 million Recovery Act funds through SEP and leveraged an additional $900,000 in matching funds from Florida utilities to develop the SunSmart Schools and Emergency Shelters Program (DOE 2014). The program installed more than a megawatt of solar power across 118 schools designated as emergency shelters throughout the state**.** By the end of June 2013, the SunSmart systems had generated an estimated 2084 MWh of energy, which when translated to energy costs is worth $208,400 with savings of over 1400 tons of carbon dioxide emissions (FSEC 2014). This project resulted in an annual savings of approximately $133,346 for the entire project or $1,258 per school.[6] These 10-kilowatt solar arrays make electricity available when the power grid is compromised, while offsetting electricity costs during normal operations, making the shelters safer and more secure. The systems are an example of an important measure to mitigate against power outages in the wake of a natural disaster and have been activated during four hurricanes between 2010 and 2017 (FDACS OOE 2017).

Puerto Rico's Residential Solar and Battery Storage Project

On September 20, 2017 Hurricane Maria made landfall in Puerto Rico as a strong category 4 hurricane, resulting in unprecedented destruction across the entire island. Maria left Puerto Rico's 3.7 million residents without electricity. The resulting response was the longest sustained mission of food and water delivery in FEMA's history (FEMA 2018). In the aftermath of Hurricane Maria, the Department of Economic Development and Commerce, which manages the Puerto Rico state energy program began developing a residential energy resiliency solar program to mitigate against long term power outages in response to another major natural disaster.

State Energy Data Report available from DOE's Energy Information Administration. The prime recipient for this funding are the respective state energy offices.

[5] This data is state-reported by each state into DOE's Performance and Accountability for Grants in Energy (PAGE) platform as part of each grantee's required annual reporting.

[6] This data is state-reported by each state into DOE's Performance and Accountability for Grants in Energy (PAGE) platform as part of each grantee's required annual reporting.

In 2018, approximately $240,000 of SEP funds were invested into this project (DOE 2019b). The objective was to increase residential energy resiliency, while also reducing energy consumption from the grid. There were 20 homes, mainly in the municipalities of Arecibo and Caguas. The homes in this project were selected based on the following criteria: i) Homes had been previously weatherized by Puerto Rico's Weatherization program, ii) Located in areas where PR energy grid showed extreme vulnerability, iii) Located out of flooding zones, and iv) Homes that were without power for more than 60 days. Also, participants agreed to voluntarily send monthly electricity bill to be evaluated. In total, 54 kW of PV solar was installed as well as battery cycling capacity of 80 hours per home based on manufacturer specifications. As a result, participants reported a reduction of 10 to 15 Kwh per month (on average) on the project per home. As part of a qualitative assessment, participants were asked about the benefits they see in having the system. Participants have reported feeling safer and confident in having electricity when there is another major power outage. This was particularly important for residents who are elderly or have underlying health conditions (DOE 2019b).

Kentucky Energy Assurance Toolkit for Local Government

In Spring of 2020, the Kentucky Energy and Environment Cabinet (EEC) partnered with the Electricity Infrastructure Security (EIS) Council, a local government coalition, and launched the Energy Preparedness Program, which is a statewide initiative to aid local planners, emergency managers, and civic leaders in planning for energy needs (KY EEC 2019). From this initiative, Kentucky developed an Energy Assurance Toolkit for Local Governments, which serves as a repository for the essential elements needed to develop and institutionalize an Energy Assurance plan for local governments. It provides a structured process to build a team, develop a plan, and procure the information needed to execute the plan (KY EEC 2019a).

Missouri Roadmap to Resilience for Small and Medium Sized Communities

Currently, the Missouri Department of Natural Resources is partnering with three small- to medium-sized communities (City of Stockton, City of Rolla, and City of St. James) to develop a Roadmap to Resilience, which provides resources, best practices, and tools for how communities can strengthen community resilience and critical infrastructure. Part of this project aims to improve the energy efficiency in buildings and homes in an effort to mitigate against natural disasters. Upon completion, the roadmap and the cases studies developed from the partner communities will serve as a resource for other communities across the nation (DOE 2019a).

These projects showcase how energy efficiency and renewable energy plus storage technologies can serve an important role in mitigation against natural disasters. Collectively, the federal programs described above potentially total over $16 billion in federal funding for states to invest into mitigation and resilience activities. The energy sector is cross-cutting and relevant to all of these programs. In particular, energy efficiency and renewable energy technologies have the potential to empower stakeholders to build stronger, more resilient infrastructure that can better withstand the impact of natural disasters. While FEMA, HUD and DOE programs and examples are highlighted, there is a larger effort for all federal agencies to collaborate on disaster mitigation through the Mitigation Framework Leadership Group.

Federal Interagency Coordination and Disaster Mitigation

Mitigation Framework Leadership Group (MitFLG)

The Mitigation Framework Leadership Group (MitFLG) was formed in 2013 to provide national coordination of Federal efforts to deliver mitigation needs identified from stakeholder input and federal priorities (FEMA 2015). The MitFLG's mission is to strengthen the nation's disaster resilience by expanding mitigation awareness, coordination, and action. It does this through coordination with 14 federal agencies and nine state, local, tribal, and territorial governments (SLTTs) (FEMA 2020d). SLTTs are important members of MitFLG due to their on the ground insight and unique perspective on gaps and needs.

The State of Tennessee, through the Tennessee Department of Environment and Conservation, is one of MitFLG's SLTT members and a contributing voice on disaster mitigation and preparedness to combat natural disasters that can affect the energy system. Tennessee practices disaster mitigation and preparedness through training exercises and ongoing development of their State Energy Assurance Plan which helps identify state specific mitigation, preparedness, response and recovery in the energy sector. They help drive coordination through their Emergency Support Function—Energy (ESF#12) and developed an energy security checklist which provides detailed guidelines to determine short term response measures in the event of an emergency and the resources available to maintain energy reliability to the state (TDEC 2018).

MitFLG follows the priorities of the National Mitigation Investment Strategy (NIMS) released in 2019 and is the most recent national strategy for advancing mitigation investment to reduce risks posed by natural hazards (FEMA 2019). From the NIMS, FEMA built four internal Working Groups—Share, Measure, Integrate, and Demonstrate—where federal agencies and SLTT can determine priorities and design implementation strategies for mitigation (FEMA 2020d). MitGLG follows FEMA's Community Lifeline approach, including coordinating with DOE to support the Energy Lifeline. The Energy Lifeline includes essential elements such as the power grid, temporary power, and fuel. There are various measures to mitigate these elements from disasters and in particular energy efficiency, renewable energy and storage can assist in maintaining temporary power (FEMA 2019e). Future examples and best practices from stakeholders on utilizing different technologies to support the Energy Lifelines will be essential for MitFLG's priorities and strategies.

Conclusions

In order to build resilient communities, it will be critical to leverage various funding sources, increase public sector collaboration across federal, state and local levels, and underscore the value of integrating energy efficiency and renewable energy technologies as part of pre-disaster mitigation planning and projects to different stakeholders. The energy sector is cross-cutting in that it is not only needed to power our homes, but also our nation's critical infrastructure. Energy efficient buildings have a strong potential to provide complimentary benefits to mitigation and resilience projects. For instance, when a critical public facility needs less energy to function, it also needs less backup generation on-site to operate when the grid goes down and lower electricity demand translates into lower initial cost for distributed energy resources investments such as renewable plus storage (DOE 2019d). Integrating both efficiency and renewable plus storage technologies into buildings and community centers can serve to

lower operational costs, mitigate against power outages, and act emergency hub in times of disasters. In our research, we have identified key pathways to integrate energy efficiency and renewable energy plus storage technologies as part of pre-disaster mitigation planning and projects moving forward.

Leveraging Various Funding Resources.

Many states and local communities are looking for various funding sources to not only develop robust energy resilience and mitigation plans, but also implement those projects. This is where there is an opportunity to build on existing interagency collaborations to make federal resources easily accessible. Leading a coordinated effort is done best when information is centralized and there are strong established channels for stakeholder engagement. A coordinated federal effort is critical as well as providing examples of viable projects that integrate energy efficiency and renewable energy as part of pre-disaster mitigation measures to support innovative solutions to mitigate against natural disasters. An example of this is FEMA's Mitigation Leadership Framework Group and various interagency collaborations. These collaborations disseminate information to grantees and community action partners about the potential to integrate energy efficiency and renewable energy plus storage.

Collaboration Across Federal, State, and Local Agencies.

To further integrate energy efficiency and renewable plus storage technologies into pre-disaster mitigation plans and projects, there is a potential opportunity to convene stakeholders across federal, state, and local levels. Building on federal interagency efforts led by FEMA to empower the federal community to invest in mitigation efforts, it is important to encourage state-level efforts that could strategically and effectively support local governments in their jurisdiction. Disasters occur at the local level, and, while there is coordination as part of the emergency response and recovery process, there is an opportunity to actively integrate state and local partners to collaborate more as part of the pre-disaster mitigation planning process. It is in the planning process where the value proposition of how to integrate energy efficiency and renewable energy plus storage can serve to support various state agency's missions to have the most impact within the community they serve. This stakeholder engagement will further support innovative energy projects.

There are various examples of successful state and local engagement. In 2016, the Commonwealth of Massachusetts launched the Municipal Vulnerability Preparedness (MVP) Program from an Executive Order, which couples state and local collaboration with energy efficiency and preparedness by guiding and funding states in their development of resilience plans (MA EEA 2016). As a results of this partnership, 157 municipalities have been designated as MVP communities and 37 more are completing MVP Planning Grants for FY2020 (MA EEA 2020).

These types of state and local collaborations are key to leveraging various federal funding to integrate energy efficiency and renewable plus storage into mitigation and resilience projects. We have found that not only is the dissemination of federal resources important for these partnerships, but also in creation of actionable items that state and local stakeholders can use to execute their respective plans. These can take the form of action planning workshops or leveraging regional, local, and county hazard mitigation planning events to bring information to stakeholders. The opportunity space for energy efficiency and renewable energy plus storage to be an integral part of mitigation and resiliency projects lies between collaborative planning

across federal, state, and local stakeholders and developing the innovative solutions that deliver a value proposition to these different groups.

Furthermore, it will be important for federal partners to equip state agencies with readily available resources, tools, and action plans on how to best integrate energy efficiency measures and renewable energy technologies that can serve to enhance future mitigation projects.

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