Testimony of Suzanne MacDonald
Community Energy Director, Island Institute

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I. Introduction

Senator King, members of the Committee, and the community of Searsmont, thank you for the opportunity to testify today. My name is Suzanne MacDonald and I'm the Community Energy Director at the Island Institute, a non-profit organization based in Rockland, about 30 minutes down the road from here. It's an honor to be able to host you here in Midcoast Maine and discuss the intersect between energy, economy, and community sustainability in rural parts of our state and nation.

Senator King, I also want to thank you for your leadership on the energy issues that face our state. If not for your storytelling abilities, Mainers would not be so acutely aware of the impact of our energy choices. I also appreciate your keen understanding of the issues we face on the islands: two years ago, when you delivered the keynote address at the 2015 Island Energy Conference – an event that draws 150 local energy leaders from New England islands, Alaska, and Hawaii – you noted that, **"we are in the midst of an energy revolution and the islands are Bunker Hill."** The battle to build more resilient economies is indeed daunting, but we are eager to share what we are learning. As you know, island communities can serve as microcosms for the rest of the world, providing valuable lessons for other communities and other sectors as they consider microgrids and distributed energy systems.

I also want to recognize the U.S. Department of Energy for the technical assistance it provides to Maine's island communities and for the support it has given the Island Institute and our partners from around the U.S. so that we can exchange lessons learned. We have seen first-hand the value of the department's involvement and deeply appreciate the assistance we have received from the WINDExchange and State Energy Programs, as well as the Energy Transition Initiative.

II. Island Institute

I've spent the last decade working with islands and other remote communities to help them better understand and confront their unique energy challenges, primarily at the Island Institute, a 34-year-old community development organization. Our staff of 55 works to sustain Maine's island and remote coastal communities and exchange ideas and experiences to further the sustainability of communities in Maine and elsewhere. We work across three strategic priorities: strengthening local economies, education and leadership for the future, and delivering and sharing solutions. We're working with local partners to tackle a suite of complex challenges including access to broadband, diversifying livelihoods, and lowering energy costs, all with the end goal of making the Maine coast a more viable place to live, work, and raise families.

III. Maine's Island Communities

The Island Institute's primary constituents are the residents of the remaining 15 year-round, unbridged islands in the Gulf of Maine (in 1900, there were more than 300 islands with year-round communities), as well as coastal communities from Portland to Eastport, next to the Canadian border. While several of our islands have communities of less than 100, collectively, the islands have a year-round population of approximately 4,500 residents that can nearly triple during the summer months; our 120 coastal and island communities have a population of approximately 450,000, 34% of the state's population.

Not unlike much of the rest of Maine and other isolated areas of the U.S., our partner communities are heavily reliant on the natural resources that surround them; in Maine, that is primarily commercial lobstering. It is worth noting that the American Lobster is the single most valuable species of fish landed in the entire country and 80% of the lobster catch comes from Maine. Three of Maine's communities - Rockland, Vinalhaven, and Stonington - landed about $114 million dollars worth of lobster in 2015, almost equal to the value of the combined commercial fisheries in New Hampshire, Rhode Island, and Connecticut. In 2016, Maine lobster required over 270,000 commercial fishing trips, more trips than all the commercial fisheries in any other state on the East Coast. Virginia fishermen took the next most, with 220,000 trips aggregated across all of the fishermen in the state. Despite the lobster's prominence in Maine's economy and its apparent success on paper, the fishery is facing a variety of economic and environmental challenges. Whether it is diesel for lobster boats and trucks to transport the 130,000,000 pounds of live lobsters fishermen caught in 2016 or electricity to power bait coolers, co-ops, and the rest of the lobster supply chain, inexpensive energy is a cornerstone of a thriving coast.

Despite our need for affordable energy to power our economy, Maine's island communities pay some of the highest energy costs in the nation. While many of our islands are connected to the mainland grid by submarine cable, several communities have had to use local utilities, mostly electric cooperatives, to finance submarine cables and on-island grids. The resulting rates range from $0.28 to $0.39 per kWh. On the islands where laying a cable is cost prohibitive, communities have relied on antiquated diesel generators. In addition to age and maintenance concerns, these systems require the importation of fuels year-round. The resulting electricity rates in these communities are in the $0.70 per kWh range. Unlike ratepayers in other isolated regions of the U.S., Maine island ratepayers do not receive any subsidy for their power bills.

Island energy challenges are even more pronounced when it comes to heating. While Maine has the distinction of having both the oldest building stock and the highest dependency on home heating oil in the country, this combination is even more pronounced on islands. These small communities have no hope for natural gas service, and heating fuels often cost a dollar or more than they do on the mainland. We often hear residents on the outer islands are kept up at night when the harsh winter winds hammer their exposed communities, worrying as much about the impact on their wallet as they are about the structural integrity of their home.

As we have been discussing today, high energy costs compound to create massive economic implications for residents, business owners, and municipalities in ways that can threaten the long-term viability of communities. Since energy is a critical input in rural economies, high costs create barriers and limit options when seeking to maximize the profitability of existing industries or to diversify livelihoods. Proactively investing in strategies to lower costs is imperative if we hope to be able to respond to the shifting economic, ecological, and social conditions of our world today.

Just like many of the forestry sector's host communities in northern and western Maine, our island communities are at the edges. Being a frontier community means that we often face complex challenges, ranging from transportation logistics to limited service providers and the ability to replace aging equipment. But more often than not, we see how these challenges drive innovation and lead to important breakthroughs out of the need to "get it done." When it comes to energy, the quest to reduce costs means reducing our reliance on imported sources through energy efficiency measures and the integration of cost-effective renewable energy. Energy efficiency appeals to our Yankee heritage of "doing more with less," and renewables appeal to our "make do with what you have" ethic. It's my hope that these themes, and the projects that have resulted, resonate with the forest products sector.

IV. Investing in Projects: Island Case Studies

Maine's islands exist as a part of a cohort of six historically diesel-powered islands in New England: Block Island in Rhode Island; Cuttyhunk and Naushon in Massachusetts; the Isles of Shoals in New Hampshire; and Matinicus and Monhegan in Maine. For the past five years, each of these islands has been working to diversify local electricity generation with innovative projects that prioritize providing safe, reliable, and affordable power, while taking a systems-level approach to address multiple energy issues and maximize community-wide benefit. These projects primarily integrate large-scale solar and storage systems with diesel as backup, and have taken steps to optimize on-island loads like wastewater treatment plants to better match generation output.

While they lack a physical connection to a larger grid, these communities do not operate in a vacuum when it comes to mainland-based activities. For example, New England islands, including Martha's Vineyard and Nantucket, are at the frontlines of the U.S.'s emerging offshore wind industry. Islanders recognize that having privately-owned, grid-scale generation projects in their backyard can create opportunities - as we've seen on Block Island where the nation's first offshore wind farm enabled the community to lower costs and stop importing a million gallons of diesel per year - but that it can also create a host of challenges when it comes to evaluating the potential for grid interconnection, disruption of current community uses like commercial fishing, negotiation of community benefits, and public acceptance. As such, these communities must keep tabs on the state and regional initiatives at the same time as trying to solve their problems at home.

- **Monhegan Island, 12 miles out to sea, population 70**

Known as a lobstering community and artist colony, tiny Monhegan Island, just to southwest of Searsmont, is emblematic of energy challenges that I have seen resonate from the Hawaiian island of Molokai, to Alaskan villages, to the Maine Woods. These include: complete dependence on costly, imported fuels; aging generation equipment; an inefficient grid; barriers to financing; and median household incomes below national and state averages, all of which combine to inhibit economic growth and challenge ideals around local ownership and public acceptance. Thanks to a group of committed local leaders, extensive partnerships, technical assistance, and federal support, Monhegan is using a host of strategies ranging from Combined Heat and Power (CHP), to community-wide efficiency initiatives, and investing in energy literacy and leadership to make deep progress on its challenges.

Plagued with persistent technical problems almost as soon as its centralized 300 kW diesel plant became operational in 2000, the quasi-municipal Monhegan Plantation Power District (MPPD) and its dedicated operators - primarily fishermen who were good at working on engines - tried for more than a decade to find the parts and service providers to help them to improve the quality of service

on the island. Eventually, skyrocketing fuel and maintenance costs forced MPPD to raise rates to $0.70 per kWh. Lacking the capital to purchase new equipment, MPPD applied for and was grateful to be awarded a **USDA Rural Development High Energy Cost Grant** in 2013. Unfortunately, delays in grant administration meant that the equipment specified in the proposal - new Tier III engines to replace the Tier 0 ones in operation and a new switchgear to control them - could no longer be installed due to new EPA Tier IV requirements included in the Clean Air Act. For more than a year, MPPD was forced to delay the project and pursue alternatives that would meet the new federal requirements and local needs (Tier IV engines available at the time were vastly over-sized, costly, and extremely complex to operate, considering the realities of Monhegan and many Alaskan villages).

MPPD's evaluation led them to utilize diesel-fired microturbines in place of traditional gensets, creating the opportunity to recover waste heat from the of the four, cleaner-burning 65-kW units. Monhegan identified a nearby customer for the heat, the non-profit Monhegan Museum of Art & History, which uses it for dehumidification and space heating for its world-class collection. This initiative is part of a host of additional energy efficiency measures that the museum, supported by the National Endowment for Humanities and others, has implemented to lower energy costs, reduce the environmental impact of the museum, and improve preservation conditions. After more than five years of problem solving and effectively leveraging federal resources, the project was finally commissioned in 2017 and included including microturbines with new controls, solar photovoltaics, a heat recovery system, and, for the first time, remote monitoring.

While they will be more reliable, cleaner, and more efficient than the generators they replaced, the microturbines still run on diesel fuel. Some have asked why MPPD didn't choose a system relying on 100% renewable generation. We recognize that, in isolated areas, microgrid project design must consider operator and community priorities, fuel accessibility, challenges of intermittency, the need for redundancy, and the state of the grid. Decreasing dependency on diesel or traditional power sources to a new system requires a delicate balance of costs, technology, safety, and reliability in a remote environment, whether it be an island or a facility in the forest products sector.

Monhegan has another lesson for the forest products sector: energy efficiency investments made in advance of generation upgrades can help to reduce demand and enhance returns. Having learned first-hand about a similar effort on Naushon Island, MPPD invested in electrical efficiency measures through bulk purchases for its ratepayers before embarking upon the power station upgrade, impacting peak load, reducing the need for new generation, and providing ratepayers with some relief. In terms of thermal measures, leveraging Efficiency Maine grants and rebates, 87% of Monhegan's year-round homes have been weatherized through a community-based Weatherizaton Week program. Barging a spray foam insulation truck out to the island, which has no car ferry, was a once-in-a-lifetime opportunity for residents. Needless to say, the truck returned to the mainland empty. With these measures combined, Monhegan is likely the most energy efficient in the state of Maine.

- **Matinicus Island, 22 miles out to sea, population 74**

Maine's other diesel island is Matinicus Island, a community 22 miles out to sea with a population of 74. When AlexAnna Salmon, a community leader from the small Alaskan village of Igiugig, visited Maine in 2015, she noted the similarities between her home and Matinicus: small population, similarly-sized load, dependence on diesel, and high costs. Matinicus and Igiugig also share a vision for broadening the benefits of their energy systems (on Matinicus, waste heat from the plant is

piped into the nearby fire barn to keep water from freezing during the winter months), as well as a willingness to invest in alternatives like energy efficiency and renewable energy.

Unfortunately, Matinicus, like Monhegan and many Alaskan villages, has also struggled with the Tier IV requirements. These requirements are preventing the community from upgrading to more efficient generators that would reduce emissions from the current antiquated generation capacity but are Tier III instead of Tier IV. Today, the municipal power company is seeking the right technical and financial partners to make a significant shift in generation and build a solar-storage-diesel project. Fortunately, they stand to learn from the investments made by island colleagues in the region and other remote communities in the U.S. developing microgrid solutions.

New England microgrids also have the potential to learn from grid-tied island communities, and vice-versa.

- **Isle au Haut, 7 miles out to sea, population 73**

Isle au Haut is a small island currently connected by a 32-year-old, seven-mile unburied subsea cable that is essentially the equivalent of an extension cord to the mainland, providing power to the island at $0.39 per kWh. In their evaluation of replacing the cable, local leaders are finding that it could be more cost-effective to give up their connection to the mainland and go with a local microgrid solution. Sized to meet their peak load in summer, excess solar power in the winter would be used to charge batteries as well as air source and hot water heat pumps in community facilities. Taking a page from the playbook of several Alaskan villages using excess wind power for space heating, Isle au Haut could utilize demand response technologies to further decreasing reliance on imported fuels to the island both in terms of electricity and.

- **Vinalhaven and North Haven Islands, 12 miles out to sea, population 1,520**

The microgrid sector can also learn from grid-tied islands that have the ability to simulate islanded energy scenarios. For example, in 2011, the Fox Islands Electric Cooperative, which serves 1,800 seasonal and year-round ratepayers on the islands of Vinalhaven and North Haven, used Fox Islands Wind, the coop's 4.5 MW wind power project, to pilot an innovative demand response project where, when pricing was advantageous to do so, excess wind power generated by the project during the winter months was sold on the island for space heating with electric thermal storage units instead of being exported to the mainland. The project demonstrated an opportunity for the coop to generate more revenue from the wind project and for homeowners, businesses, and non-profit organizations to reduce their heating costs by nearly 30%.

IV. Investing in People: Examples of Successful Capacity Building

While the microgrid sector is often dominated by discussion of technical and financial design, we believe that projects cannot be successful without simultaneously investing in local leaders. In the small communities that can benefit most from these systems, residents wear many hats and may have limited time and technical expertise to contribute to solving a problem, even if the motivation for change is high. Making a project like the one on Monhegan work is a tremendous lift that ultimately depends on empowered leaders, local ownership of solutions, and grounded partners. As such, it is crucial that any effort to expand the microgrid sector purposefully recognize and address these issues.

At the Island Institute, we seek to serve as a "bridging organization" that can invest in and connect communities to the resources they need to get the job done. Our work accomplishes these goals

through a suite of programs that enhance energy literacy, leadership, networking and peer-to-peer support, and technical and on-the-ground assistance - all of which we believe have relevance beyond the coast of Maine. With more than three decades of on-the-ground experience, we believe that we are uniquely positioned to play this role, and encourage others investing in this space to consider if there is a bridging organization that can help to invest in their efforts.

Examples of our efforts include:

- **Islanded Grid Resource Center**

When Matinicus resident Eva Murray heard AlexAnna Salmon's story of Iguigig, Alaska, she responded, "(it) really struck a familiar note. 65 kilowatts. 70 cents a kilowatt-hour. OK, we're in this together." This reaction is in part what prompted the Island Institute to partner with the Renewable Energy Alaska Project (REAP) to establish the DOE-funded Islanded Grid Resource Center (IGRC) in 2014, recognizing the similarities that remote communities in our region share. The IGRC was established to build a network of wind operators, government agencies, researchers, technical experts, and others to increase information sharing and capacity building for islanded grids, eliminate redundant efforts, promote collaboration, and ensure that best practices and performance analysis related to the operation of wind, wind-diesel hybrid and other hybrid systems are effectively disseminated. We deliver capacity-building programming that includes a series of regional convenings, peer-to-peer exchange trips, and webinars, as well as maintain a website (www.islandedgrid.org) that serves as a clearinghouse for information on people, projects, and technical resources that can inform project development and implementation in remote areas.

- **Technical Assistance (TA) Partnerships**

Providing local leaders with access to high quality, trusted, and understandable technical information and analysis can also be key component of long-term energy planning and informed decision-making. Over the past two years, DOE's Energy Transition Initiative (ETI) have been supporting Maine island communities, particularly Monhegan and Isle au Haut. ETI provides a proven framework and technical resources and tools to help islands and other communities transition their energy systems. ETI programs available to the Island Institute and its partners include the Islands Playbook, an action-oriented guide that provides a readily available framework that any community can use to help successfully initiate, plan, and complete a transition to a clean energy system, as well as a host of related tools, trainings, and TA.

The ETI program facilitated a partnership between the Island Institute and the National Renewable Energy Laboratory (NREL)'s Technology Deployment program to utilize NREL's Renewable Energy Planning and Optimization (REopt) energy planning platform. REopt has analyzed cost-optimal paths to help Maine island communities reduce their fuel consumption and lower their energy costs through the microgrid systems and related measures. This in-depth analysis provides insights on how to operate existing energy assets and incorporate new energy assets to reduce costs, meet energy or carbon goals, and improve resiliency, providing communities with highly valuable information for their local decision-making processes. decision-making.

- **Island Fellows**

Small communities often have a need for an extra set of hands maximize the value of TA and implement their priority projects. The Island Institute's Island Fellows is a model program for just this kind of support. For example, an Island Fellow recently spent two years supporting the power companies on Monhegan and Matinicus, collecting and analyzing load and fuel data, managing the

logistics of community-wide transitions to LEDs, and interfacing with island schools. Importantly, the Island Fellow served as the bridge between the community and the DOE and NREL technical assistance staff, taking the time to compile the local data that were invaluable to the process and translating between each group, ensuring the most relevant and actionable outcomes from the modeling process. Fellowships are designed to help increase local capacity to carry on their work and increase the long-term sustainability of their efforts, so the benefits will outlast the placement.

V. Considerations for the Committee

- **S. 1460**

We were pleased to see that many of the themes expressed in this testimony are also reflected in the microgrid provisions for isolated communities found in S. 1460. In particular, we appreciate the considerations for input of traditional knowledge from local leaders, development of the local workforce, and increasing capacity of local and regional research partners. It is our hope that these provisions will extend beyond Alaskan villages to include the island communities that I have discussed today, as well as to include community development and bridging organizations in addition to research facilities to provide critical, on-the-ground and translation support.

Expanding our collective capacity to build microgrids at both the community and commercial scale will enable U.S. companies and technologies to establish themselves, build a successful track record, and gain competitive market advantages abroad where microgrids market is rapidly expanding. Beyond this, I encourage the Committee to consider the following lessons learned from our work:

1. **Make Meaningful Investments - Investments that are a blend of infrastructure, technical assistance, and local capacity building are more likely to succeed and to be more durable than investments in any one strategy on its own.**

Addressing the significant challenges facing islanded grid communities from Maine to Alaska will require significant investment. As we have seen on Monhegan, support from programs like USDA Rural Development's High Energy Cost Grant have provided the financial backing that private entities have so far been unwilling to invest. We encourage the Committee to consider ways to leverage federal resources, technical and financial, to drive greater investment in these projects that can make all the difference for remote communities and provide valuable lessons for the rest of the world. Blending investments to include TA and local capacity building like the examples referenced above can achieve this goal. This type of blended assistance helps to make the TA more meaningful and accessible to the community, and allow it to endure beyond the presence of the TA provider.

2. **Microgrids create the opportunity to address multiple energy challenges at the same time - the flexibility to be able leverage investments in electricity, heating and/or transportation can significantly enhance economic and community development outcomes.**

Thinking beyond electricity generation to consider other significant energy burdens such as heating and transport can maximize the cost-effectiveness of a microgrid project, as well as the local benefits of it. When islands and remote areas can access the technical assistance and other partnerships that they need to holistically evaluate their options, it can open the door to leverage multiple sources of financing, create longer-term and larger-scale benefits, and build economies

that are truly more resilient. We encourage the Committee to consider ways to encourage this integrated way of thinking.

3. **Share What Works - make cost effective investments and leverage lessons from elsewhere and build on other work funded by the federal government.**

Sharing solutions that work is powerful. When similarly-situated people and communities effectively share their experiences, projects can be developed more quickly and more cost-effectively. Learning from others' mistakes or difficulties helps to keep you from making those same mistakes and ultimately reduces the costs of the project. Initiatives like Islanded Grid Resource Center, those of the Energy Transition Initiative, and the DOE State Energy Program-funded Bridging the Rural Energy Efficiency Gap (an initiative to increase the uptake access to clean energy financing in rural areas of Maine, Alaska, New Hampshire, and Vermont, led by the Maine Governor's Energy Office and the Island Institute) enable us to accelerate the pace of change and make it more efficient, while creating opportunities to grow the microgrid market here, and establish the leadership of U.S. companies to export their products and services abroad. At the Island Institute, we look forward to continuing to play a role to connect with Alaska, Hawaii, and related federal initiatives, to learn from each other as well.

4. **Create reasonable exceptions for remote or island communities that help to avoid unintended impacts of various policies.**

As Congress considers ways to support the development of microgrids, I encourage you to keep Maine islands in mind, both as a place that can benefit from the right support, and also as one where the unintended consequences of well-meaning energy policies can emerge quickly. In the past few years, our communities have faced energy-related challenges that have included requirements for extremely costly retrofits to increase vessel safety standards on massive fuel tankers that have then also been applied to the very small vessels serving our islands; the restriction of transport of heating fuels on small ferries; and Clean Air Act requirements for power plants that have inadvertently created serious and costly obstacles to moving to cleaner forms of power generation and now marine vessels including larger lobster boats.

None of these policies were designed for small, rural communities, **and their application in such communities caused substantial impacts here in Maine**. Paying attention to the potential implications of energy policy on small systems - whether community-owned or owned by a small business - is critical to Maine's energy future. As you consider future laws and their impact in remote areas, please remember that communities in Maine may be challenged by them too.

VI. Conclusion

I invite the Committee and my colleagues here today to think of smart ways to forward technical and community priorities, invest in and listen to local leaders, and evaluate projects and share the lessons learned. We're confident that, with this approach, Maine islands will become more resilient and make meaningful contributions to the microgrid sector. Lowering energy costs - both through increased efficiency measures and switching to lower cost fuels - helps support our coastal economy and ultimately keeps more money in the pockets of Maine residents.

Microgrids and community resilience go hand-in-hand. Our hearts go out to the islands in the Caribbean that continue to face tremendous, immediate challenges. Here is Maine, we are starting

to recognize our own vulnerabilities to storm surge, sea level rise, a heavy reliance on diesel fuel, and the impacts that natural disasters can have to our working waterfront infrastructure and communities. From the working with Maine's island communities over the last 10 years, I strongly believe that part of being a resilient community is being able to bounce back after a disaster and one of the most important ways to build the adaptive capacity of a small community is to invest in the people.

In closing, we look forward to continuing to build diverse partnerships with from Alaska, to Hawaii, to the forestry sector in Maine to learn how microgrid and other energy solutions can help drive economic growth in some of our most rural areas of the U.S.

Thank you again to the Committee for the opportunity to testify and submit written testimony, as well as to Senator King and his staff who work so hard for the people of Maine. I would also like to acknowledge the support of the Island Institute staff members who contributed to the development of my written testimony: Brooks Winner, Janet Bosworth, Julia Maher, and Nick Battista.