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Written Testimony before the
United States Senate Committee on Energy and Natural Resources
February 15th, 2016

Madam Chair, thank you for the opportunity to testify before you today. My name is Gwen Holdmann, I am the Deputy Director for the Alaska Center for Energy and Power. Our mission is to develop and disseminate practical, cost-effective, and innovative energy solutions for Alaska and beyond. The Alaska Center for Energy and Power is a statewide, university-led, applied research program based at the University of Alaska Fairbanks. We make every effort at being responsive to immediate and long term needs of residents, industries and agencies; and we focus on research related to community and industry-scale power generation that has the potential for providing reliable and affordable energy, especially in instance of microgrids.

Of our roughly 150 communities in rural Alaska, there are about 70 projects that incorporate grid-scale renewables on community microgrids. Many are pushing penetration levels of variable renewables on a regular basis that would make most utility managers quite nervous. These are not demonstration projects. These are not pilot projects. Are they innovative? Yes. Do they work with local operators? Yes. Are they economically viable? Well, that might be a more complicated question to answer but the point is that these are examples of strategies Alaskans have adopted to provide reliable energy services in remote and harsh environments.

Just to our Southwest, the Chaninik Wind Group communities of Kongiganak, Kwigillingok, and Tuntutuliak have been working together with an Alaska developer Intelligent Energy Solutions to turn off the diesel engines and run off 100% wind energy when the resource is available, and use thermal loads in individual residences to balance the grid.

400 miles SW in the Pribilof Islands you will find the community of St Paul. The airport complex at St Paul has been operated by a subsidiary of the village native corporation in diesel off mode when there is adequate wind for 15 years with no battery system. They now have a holistic goal to meet 80% of all the energy needs of the community – heat and transportation included, from renewable resources by 2020, and has received support from DOE to help them meet this goal.

400 miles to the SE is Kodiak Island, where a combination of hydropower, wind, and storage technologies including a battery and small flywheels support a grid that is almost 100% renewables on a year-round basis for a community of about 10,000 residents.

500 miles to the NE is Fairbanks is one of the largest battery systems in the world, a 27MW supporting the Golden Valley Electric Association grid and the northern portion of an intertie between Fairbanks and Anchorage. Even our main grid, connecting Anchorage and Fairbanks and extending a bit beyond that, is essentially a series of overlapping microgrids that can operate independently and are not connected to Canada or the rest of the US.

Point 1: I would like to take to this opportunity to acknowledge the long and important history the Department of Energy has had in working with Alaskans to develop energy solutions for our communities. DOE has had an important role in dozens of projects spanning a wide range of technologies, including some of the projects I mentioned earlier. However, I would like to call out three programs specifically. First of all, I would like to acknowledge the Office of Indian Energy who has significantly increased their efforts in Alaska in recent years. Secondly, I would like to mention the DOE EPSCoR program, which has been the single greatest factor in building a research based center of excellence in microgrid technologies in Alaska. Finally, I would like to mention the Office of Electricity, and program managers Imre Gyuk and Dan Ton. OE has been absolutely wonderful in terms of understanding the need to partner directly with states, and to listen to local organization and partners and ultimately to build on those efforts that are already underway and have local support. To give them a push to give them some momentum and direction, but leaving it to local people to set the agenda and define the needs. They perfectly exemplify the hand up, rather than hand out attitude, and understand that being effective is deeply rooted in meaningful partnerships, and serving as a connector and a catalyst, rather than the knight in shining armor coming it to rescue the poor peasants in the hinterlands of Alaska.

Point 2: I would also like to applaud Senator Murkowski and her colleagues for the ambitious effort represented by the Energy Policy Modernization Act. In preparation for this hearing, I made the mistake of hitting 'print' on the bill and then realized it was 423 pages. I mean, does anyone actually read these bills from cover to cover? We resorted to a key word search and I will be submitting specific comments on the bill as an addition to my written testimony. But I did thought there was one point I would make today. I've been using the word 'microgrids' to describe Alaska's community energy grids, but actually they don't qualify as microgrids by DOE's definition, or at least is open to some interpretation. DOE's definition of microgrids is: "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in grid-connected or island-mode." Because Alaska's grids are never connected to a larger grid, we fail the second part of that definition, but we are not alone. So do the hundreds of other small community grids in the Pacific region, and the developing world.

Perhaps the Energy Policy Modernization Act is an opportunity to also update the definition of microgrids to recognize that Alaska systems are also a form of microgrid. Or perhaps DOE can take the initiative internally to make this change. From my perspective, this is more than an issue of semantics, it both creates challenges in our ability to respond to national funding opportunities, and also I think creates a bit of a divide that insinuates that the systems we have in Alaska bare little resemblance to the microgrids in the rest of the country, and thus what happens here or is developed here is largely irrelevant to the rest of the country.

Point 3: It is the final point I would like to take some time to expand upon. According to Navigant Research (and I would welcome a joint effort to refine this number), Alaska has about 12% of the microgrids in the world. Not islanded or remote systems, but microgrids in the broader sense of the definition. These have in very large part been funded by the State of Alaska, through programs like the Renewable Energy Fund and the Emerging Energy Technology Fund. Over the course of the past 2 decades, we have built up a substantial body of knowledge related to the design, construction, and operation of these systems. I have a real vision for the future of Alaska, and how we can engage with

and participate in the development of energy systems of the future. I have a white paper here that has been signed by 49 leaders in the energy industry in Alaska, that proposes a new DOE Innovation Hub here in Alaska. It proposes an Alaska role for transformational change of the electric power market, with commonplace 100% renewable energy operation for microgrids - whether in U.S. markets or the developing world – using strategies that are cost effective from a holistic community perspective, addressing all energy requirements for the customers served, not only those that are electric. Alaska’s Energy Network Innovation Hub would include as partners Alaskan utilities, Native Corporation and Tribes, developers, non-profits, and the University of Alaska. Alaska’s microgrid-centric electric grid, high cost of energy, supportive community leadership, specialized expertise, and friendly utility industry makes Alaska the natural proving ground for the energy systems of the future. We envision this natural testing ground to serve as a living laboratory central to a different sort of Innovation Hub, where technology developers have tested and demonstrated new technologies across the energy technology spectrum, from generation technologies (wind, biomass, geothermal, solar, fuel cells) to advanced storage systems, multi-nodal small scale HVDC, highly advanced demand-side management strategies, intuitive human-machine interface approaches, and paradigms enabling acceptance of a supply-driven energy system. We wish to build on these natural synergies to enhance U.S. leadership in these critical energy technology areas, both domestically and abroad. Alaskan communities live and breathe change while living in some of the most adverse conditions in the nation. This enterprising spirit establishes Alaskans as with finely honed early adopter skills, that coupled with the widespread experience in dealing with constrained resources and challenging operational conditions, can provide an excellent venue for hardening U.S. technologies prior to deployment in emerging markets. We propose pulling together a diverse group of partners, including National Labs, Manufacturers, Developers, the Utility Industry, Academia, and Native Alaskan organizations (technology end-users) to work together to develop the *Energy Systems of the Future*, based around microgrids and holistic ‘energy networks’, inclusive of technology advances, and improved understanding of the human dimension of implementing change.

Point 4: Alaska’s leadership in hybrid microgrid technologies is exemplified by a new project sponsored under the US Chairmanship of the Arctic Council. It is called ARENA – the Arctic Renewable Energy Network Academy (ARENA). We are using the word ‘energy network’ rather than ‘microgrid’ because we want to be sure to include all of the ways energy we use energy – specifically, not just a focus on electric power but also heat, and we hope, transportation as well. Our plan is to first create a series of widely accessible video documentaries about specific projects and technologies throughout the Arctic to increase awareness of what is being done that is successful, and provide an avenue for disseminating best practices to as wide of an audience as possible. Secondly, we are planning to bring together a small but very selective group of practitioners, including energy professionals and community leaders, in Alaska this summer. Our goal is to promote knowledge sharing among people that are in the best position to influence the future trajectory of project development in their home countries and regions. We are planning to use Alaska as a living classroom to support ARENA, with our fellows touring projects relevant to their interests and interacting directly with utilities, developers, and the communities in which these projects are based to gather knowledge that can help them make good decisions about future energy development that can displace reliance on imported diesel fuel. ARENA is a formal project under the Arctic Council co-led by Canada, Iceland, Finland, and the U.S., and supported by a number of both permanent participants and other organizations based in all 8 Arctic nations. To date, our co-leads Canada, Iceland, and Finland have committed resources to this initiative. The State of Alaska and

University of Alaska have both made cash contributions to this initiative despite our challenging budget situation. The only partner who has not contributed any resources to ARENA is the lead sponsor of it – the US Government. While this is a bit embarrassing, it also does put the entire initiative at risk in terms of whether we can make the Alaska portion of the program happen, and whether we can actually include any US participants since most of the international participants are sponsored by their home nations.

In closing, I would very much like to commend you Senator Murkowski for your strong leadership for Alaska, and for the nation. I am extremely appreciative of your willingness to roll up your sleeves and really understand these very challenging issues, and then drag your colleagues up to the Alaska hinterlands so they can better understand both the challenges, and the opportunities that exist here in the 49th state.