Written Testimony
Submitted to the
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Committee on Energy and Natural Resources

On

Micro-grids
July 14, 2015

Respectfully Submitted By Meera Kohler
President and CEO
Alaska Village Electric Cooperative, Inc.

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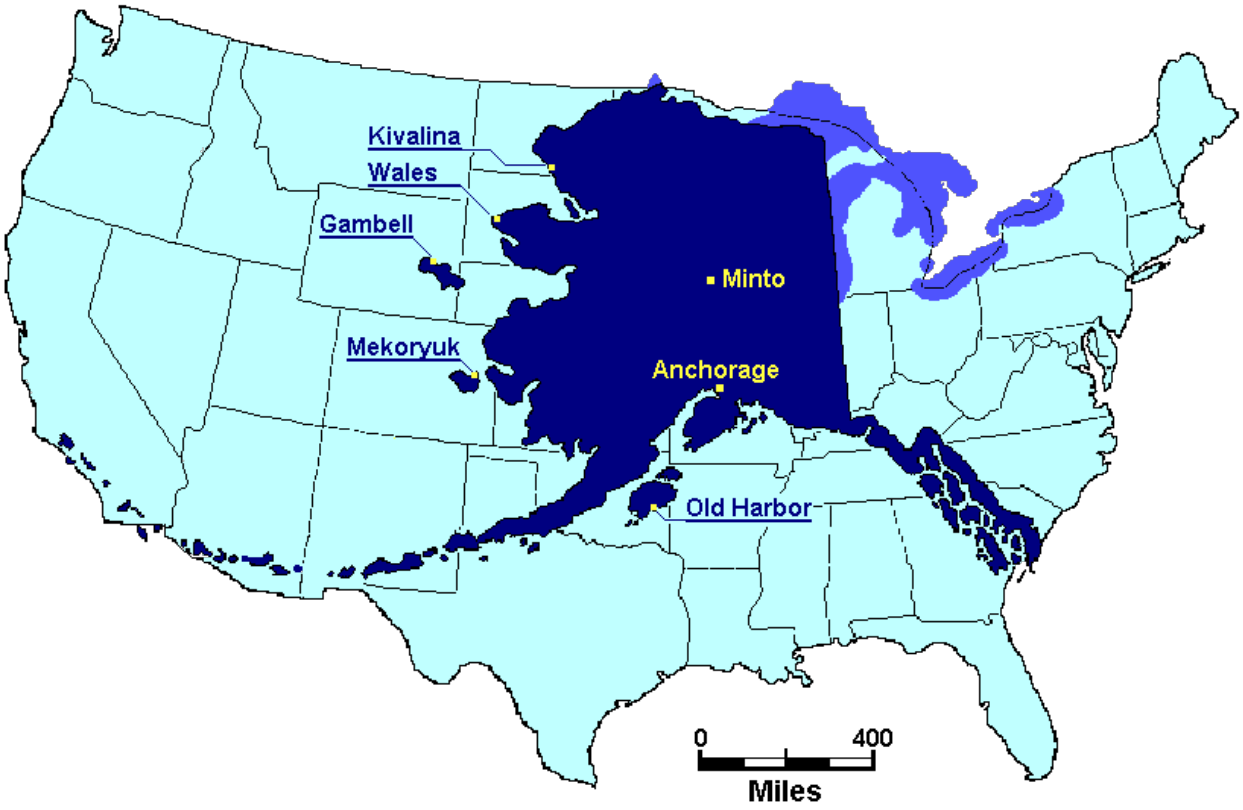
Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee, thank you for the opportunity to testify on micro-grids in Alaska.

My name is Meera Kohler. I am the President and CEO of Alaska Village Electric Cooperative (AVEC), a position that I have held since 2000.

AVEC was established in 1967 as the culmination of an effort of the then-Governor of Alaska to find a way to deliver central station electricity to the small villages that housed Alaska's rural, mostly indigenous population. The task was daunting, given the distances, geography, absence of infrastructure of any kind and extreme climactic conditions of our great state.

Working with USDA REA (Rural Electrification Administration, now Rural Utilities Service) a unique electric cooperative was established – one that would serve communities whose physical boundaries did not coincide with those of other member villages. This patchwork of electric grids began with three communities that were electrified in late1968. Old Harbor, Nulato and Hooper Bay are an average of 400 air miles from Anchorage, AVEC's base of operations and an average of 470 miles from each other.



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AVEC today serves 56 communities in Alaska and does so with 49 separate diesel fueled power plants. Several of our communities have populations of less than 100 while our largest, Bethel, has a population of more than 6,200.

Discounting Bethel, which is more than five times the population of our second largest community, the average village population is 450 – likely less than the occupants of a single apartment building in most cities.

AVEC is, in effect, operating a series of 49 micro-grids. These micro-grids do not have the luxury of connecting or disconnecting to any other grid – as are virtually all communities and subsections of communities in the Lower-48. Instead we must provide redundancy within the community to allow for planned and unplanned generation maintenance. Extended outages in a community equate to life, health and safety crises almost immediately. During the winter, houses freeze up and human life is at risk. During the short summers, extended loss of refrigeration could mean the loss of an entire season of subsistence food.

AVEC systems typically consist of a stand-alone power plant with three or four generators. Sizing is carefully done so as to operate the most efficient generator to meet the needs of the day and the season. Redundancy is determined based upon having adequate capacity when the largest generator is down for maintenance and another fails unexpectedly. As a result, AVEC owns 80 megawatts of generation to supply an average load of 12 megawatts.

In addition to AVEC's 49 power plants, we maintain diesel tank farms in each community. Because fuel is delivered by barge during the short "open water" season, we must be able to store fuel for an entire year at a minimum. Since weather can delay the arrival of the first barge, we will generally ensure that we have up to 14 months of fuel on hand by the end of the delivery season.

In this day of the drive to distance ourselves from fossil fuels, rural Alaska's dependence on diesel is surprising to an outside observer. Alaska is one of the nation's leading energy states with vast reserves of natural gas. It would seem self-evident that Alaskans' energy needs would be met with inexpensive, low-emission sources such as that natural gas. That is not possible however, because Alaska lacks the basic infrastructure that is ubiquitous in other states.

Alaska lacks roads, railways, adequate port and dock facilities, paved runways, transmission grids, communication grids and other elements deemed necessary for modern American society. As a result, we have had to develop micro-systems to meet the needs of the people who have been resident in these areas for many hundreds of years. These micro-systems come at very high cost per capita.

As an example, AVEC's investment in utility plant to serve our villages is more than $17,000 per service or meter. That is 4-5 times the investment typical in the Lower-48 and reflects the very large redundancy built into our generation system as well as the value of the fuel storage systems that go with it.

Despite these staggering costs, AVEC has nonetheless been a leader in deploying wind generation in communities with a robust wind regime. We typically install wind turbines that, at peak output, exceed the connected electrical load at the time. We install diversion systems that deflect excess wind generation to passive loads such as water boilers in water treatment plants and other public buildings and reduce the use of diesel fuel in those facilities.

AVEC has been engaged in developing wind generation since 2003 and owns and operates the largest fleet of wind turbines in Alaska – 34 machines are located in 11 communities and serve another four through modest transmission connections. We are able to achieve 25%+ of our generation from wind in communities with optimal wind regimes. In 2014, 6.4% of the electricity we sold came from wind. That is significantly better than the US total of 4.4%.

AVEC has also branched out into the tug and barge business. With diesel fuel playing a critical role in meeting the energy needs of rural Alaska, AVEC decided to enter this arena in order to deliver lower cost fuel to its constituents. The vessels were constructed in 2011 and have consistently lowered the cost of fuel transportation across the entire western Alaska market.

Alaskans do not wish to be tied to the yoke of fossil fuels, and especially diesel. Fuel spills occur routinely because the fuel is stored and handled so frequently, although rarely are they of such magnitude as to command national attention. Nonetheless, they are a continuing threat to human health and extremely expensive to respond to. That is why AVEC is committed to reducing our dependence on diesel fuel, which can only be achieved by improving efficiencies and by installing alternative sources of generation.

Efficiencies are achieved through optimizing generator output and to using the largest generator practical since efficiencies improve with generator size. We have been interconnecting communities as practical with a view toward optimizing generation efficiency and spreading the benefits of wind.

The cost of operating a power plant accounts for almost nine cents a kWh. That is the average cost of a kWh in the Lower-48 today – but is only one sixth of the cost of a kWh across our system. The chart below depicts the cost components of an AVEC kWh in 2014.

Fuel	32.45
Power Production	8.78
Admin and General	3.15
Depreciation	2.91
Consumer Accounts	1.73
Distribution	1.19
Interest	1.14
Taxes	0.47
Margins	2.87
Total	54.69

Because of the very poor economies of scale in rural Alaska, costs are very high. Each stand-alone generation and distribution system account for 1.5 full time equivalent employees and two local part time employees to operate the plant. All technical, administrative and support services are provided from our Anchorage headquarters.

To put the very small scale of these utility operations into perspective, a village's entire annual kWh consumption is the equivalent of half the consumption of a grocery store in Anchorage. All 56 of our communities together represent a population of almost 32,000, about the same as Fairbanks, but the combined electrical usage is less than 10% of Fairbanks.

Electricity is the underpinning of modern society. Without abundant, affordable, reliable electricity, modern society cannot function efficiently. That is palpable in rural Alaska and, to a lesser extent, in urban Alaska as well, where the cost of electricity is 150% that of the US average.

As we address the delivery of electricity, AVEC is keenly attuned to the interlinked needs of sustainability for our communities. Space heat is typically provided by diesel fuel as well as electricity. Again, cost-effective alternatives are simply not available or practical. Transportation infrastructure in and to our communities is almost non-existent. Economic development is stymied absent these underlying basic needs and the social fabric of the community is strained by the day-to-day struggle of existence.

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The State of Alaska has been a major player in the effort to overcome the shortfall in infrastructure to serve Alaska – a role that in the Lower-48 was largely met by the federal government. The Denali Commission has been a significant contributor when funding was available in past years. Unfortunately, their role has perforce diminished as funding sources have dwindled.

It is time for a renewed, holistic approach to meeting the basic infrastructure needs of rural Alaska. With the US chairmanship of the Arctic Council, a spotlight is being shone on the US' only arctic state – Alaska. This is where the impacts of climate change are being most sharply felt. This is where economic and living conditions most closely resemble those of developing countries. This is where the vast resources of the Arctic Ocean nurture the land and the people and whose shores will witness the evolution of new transportation, tourism and mineral extraction activities.

It is time for the federal government to partner with the State of Alaska and those of us that exist to serve Alaskans to continue and enhance the infrastructure development that is critical for our future.

In the energy sector, the State has established the Power Cost Equalization program to make a lifeline amount of electricity affordable for individual Alaskans, while non-residential users pay unaffordable electric and heat bills to operate their modest businesses. The State has established a Renewable Energy funding program that has been better capitalized than any other state. Millions of gallon of diesel are being displaced annually by projects funded by this program. The State has established low cost financing options for energy infrastructure for larger utilities. The State funds research opportunities for emerging energy technologies.

But the State cannot carry all of the necessary infrastructure development with its limited resources. I plead with you as you consider a comprehensive energy bill that you include revisions to USDOE's loan program that is currently geared toward "innovative non-commercial" technologies. It should be looking instead at deploying innovative commercially viable technologies, such as what we are trying to do on a small scale.

Besides the federal government providing more assistance for transmission in rural areas to make micro-grid systems more economically efficient, it should also provide additional aid to help reduce the currently relatively high capital costs of renewable energy system installation. While renewables in high-cost, typically micro-grid systems, may save on operating costs, their high capital costs make financing them exceptionally difficult, given their high per customer installation costs. Wind, solar, biomass/pellet fuel, hydro and hopefully marine hydrokinetic systems in the future may all provide lower cost alternatives for generation compared to fossil fuels, but their initial capital costs make financing them exceptionally difficult in most micro-grid areas.

The federal government has passed legislation to help with these costs. The Department of Agriculture runs the High Energy Cost Grant program through the Rural Utility Service (RUS) that does make grants, plus loans, available to fund the installation of renewable electricity systems, but funding for the program has been cut repeatedly over the past decade. And Congress in 2007 approved in the Energy Independence and Security Act the creation of two matching grant programs to provide grants for up to 50% of the cost of installing proven renewable energy systems in high-cost regions. Unfortunately those grant programs have never been implemented by the Department of Energy nor actually been funded by the executive and legislative branches. Providing additional funding for these programs, plus for additional transmission aid, also currently available through RUS, would dramatically improve the likelihood that islanded grids could afford to install renewable energy systems and not only reduce consumer power costs over time, but also reduce the consumption of fossil fuels with their associated emissions.

We should be expanding our vision of micro-grids to include sustainable clusters of communities that are not connected to a grid but that collectively can be served by robust technologies that represent reliable, affordable, clean abundant energy.

Thank you for the opportunity to testify.