DISTRIBUTED WIND CASE STUDY: HOMER ELECTRIC ASSOCIATION

Net Metering for Member-Owned Distributed Wind

RADWIND Project

This is the fourth in a series of case studies on distributed wind projects at electric cooperatives for NRECA Research's Rural Area Distributed Wind Integration Network Development (RADWIND) project. RADWIND's goal is to understand, address, and reduce the technical risks and market barriers to the adoption of distributed wind technologies by rural utilities. Distributed wind projects can use any scale of turbine from small kilowatt-scale units up to large multi-megawatt units, as long as they are connected on the distribution side of the electric grid. Turbines may be connected on the customer side of the meter to serve a local load, directly to the distribution grid as a utility generating asset, or directly powering an off-grid load. For more information on the project and additional resources, please visit the project landing page at www.cooperative.com/radwind.

The distributed wind project profiled in this case study is a net metering program that includes member-owned distributed wind turbines.

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Project Snapshot

Cooperative	Project Ownership	Project Size	Turbine Size	Other System Equip.	Connection	Energy End Use
Homer Electric Association (HEA)	32 HEA members (in 2021)	120 kW cumulative (wind only)	Various, ranging from 1-11 kW	Bi-directional member meters	Behind-the-meter, distribution grid	Offsets member usage

Cooperative Profile

Homer Electric Association, Inc. (Homer Electric/HEA)[1] is an electric cooperative whose service area covers 3,166 square miles of Alaska's western Kenai Peninsula. The co-op was founded in 1945, becoming the fifth electric cooperative in Alaska. When HEA's grid was energized in 1950, a 75 kW diesel Caterpillar generator provided power to a total of 45 members in Homer. Today, the HEA's 140 employees serve nearly 25,000 member-owners with an 80 MW peak load and 215 MW of generation capacity across the peninsula. See Figure 1, with HEA's territory shown in white and roads shown as blue lines.

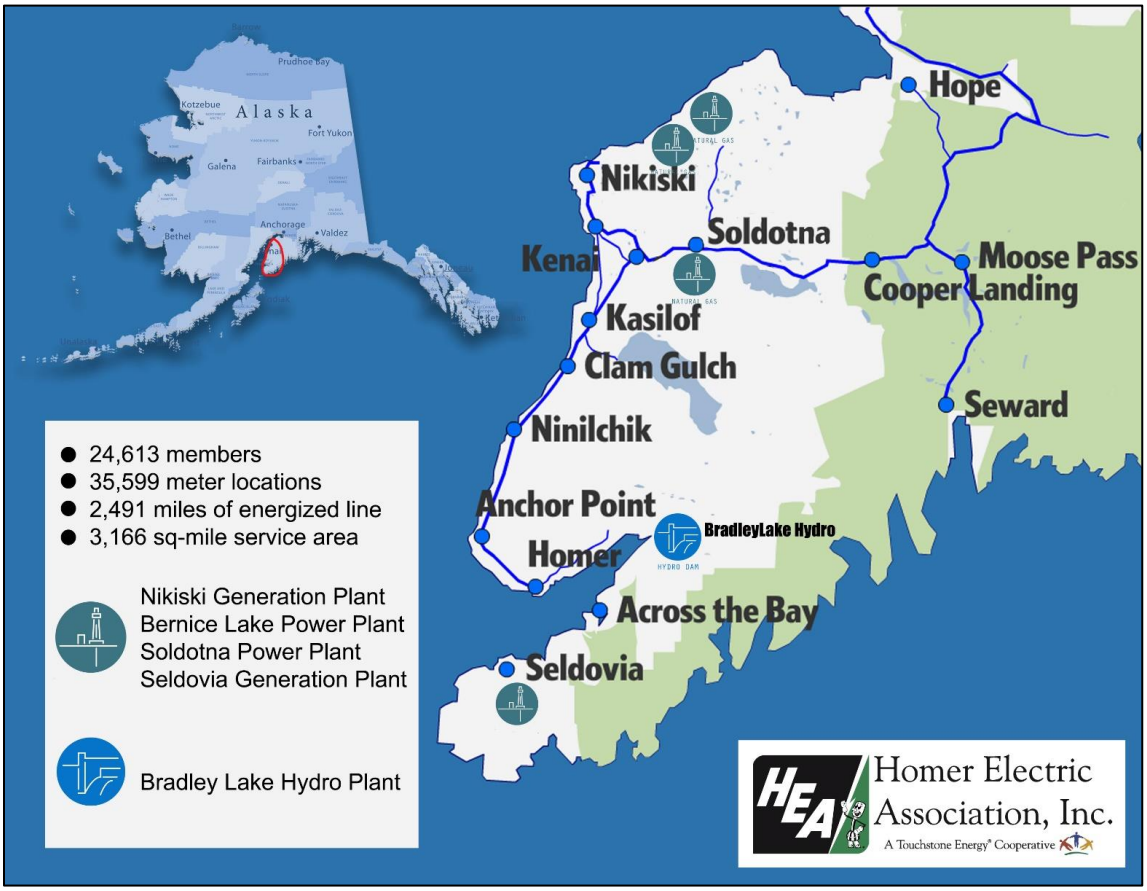

Figure 1. Homer Electric Association's Territory (white area) with Power Plants
Courtesy of Homer Electric Association

HEA is one of five utilities that comprise the state's "Railbelt Electric Grid." This grid, the largest in Alaska serving more than half the state's population and three-quarters of its electric load, is so named because this area stretching from Homer in the south to Fairbanks in the north parallels the area served by the Alaska Railroad. All of HEA's power is supplied by Alaska Electric & Energy Cooperative, Inc. (AEEC),[2] a subsidiary of HEA that holds title to substantially all of the transmission lines and substations used to serve HEA's members and handles wholesale power purchases on behalf of HEA.

[1] https://www.homerelectric.com/
[2] https://www.homerelectric.com/my-cooperative/board-of-directors/alaska-electric-energy-cooperative-aeec/

For decades, AEEC purchased power under a power supply agreement (PSA) from Chugach Electric Association and resold the power to HEA. As of June 1, 2014, the PSA expired and AEEC began producing energy directly to meet HEA members' needs. AEEC production comes primarily from one natural gas fired combined cycle facility and a new natural gas fired combustion turbine. AEEC also has three older combustion turbines that are used to meet HEA's load when airborne ash from volcanic events would be exceptionally harmful to their newer, more efficient generation assets. AEEC also operates and maintains the state-owned Bradley Lake Hydroelectric facility under contract with the Alaska Energy Authority and owns a standby diesel generation facility in a remote community that is not on the road system.

Adding to this power supply, in 2010, HEA became the first utility in Alaska to offer a net metering program to members "designed to encourage the development of member-owned renewable energy systems."[3] This program compensates members who own grid-tied, small-scale (less than or equal to 25 kW) renewable energy systems for generation in excess of the owners' needs.

Project Background

Prior to the introduction of the net metering program, HEA members who generated their own renewable energy could participate in the co-op's Sustainable Natural Alternative Power (SNAP) program,[4] which began in 2008.[5] Through SNAP, members with small-scale renewable energy systems provided all of their generation to the co-op, and other members could compensate SNAP participants through voluntary donations on their bills. Most of HEA's SNAP participants had distributed wind turbines. According to Tyler Cheatwood, engineering project specialist and net metering program manager, although many HEA members were supportive of renewable energy, donations to the program declined over time.

The next year, in 2009, the Regulatory Commission of Alaska (RCA) began a rulemaking procedure that enabled HEA to offer a net metering program as a replacement for SNAP. The rule went into effect in mid-2010 for all electric utilities in Alaska, including electric cooperatives, that are subject to economic regulation[6,7] in Alaska and have annual sales greater than 5 GWh.[8,9]

HEA was the first utility in the state to offer a net metering program under the new RCA regulations. Initially, all 26 SNAP participants (18 wind and 8 solar PV) transferred to the new net metering program, and by the end of 2010, the program had increased to 37 total participants (26 wind and 11 solar PV). The net metering program has grown substantially since then, with more than 400 participants as of May 2021. Of these, 37 have wind turbines while, with the exception of one biodiesel system, the rest have solar PV.

[3] https://www.homerelectric.com/energy-efficiency/residential-energy-saving/renewable-energy/
[4] https://programs.dsireusa.org/system/program/detail/764
[5] Originally developed by Chelan County Public Utility District in Washington State, SNAP is also offered by Golden Valley Electric Association (AK).
[6] "[E]conomic regulation is the explicit public or governmental intervention into a market that is necessary to achieve public benefits that the market fails to achieve on its own." The Regulatory Assistance Project (RAP. (March 2011). Electricity Regulation in the U.S.: A Guide. Available from: https://www.raponline.org/wp-content/uploads/2016/05/rap-lazar-electricityregulationintheus-guide-2011-03.pdf
[7] See also: https://www.econlib.org/library/Enc/Regulation.html
[8] https://programs.dsireusa.org/system/program/detail/3734
[9] http://www.akleg.gov/basis/aac.asp#3.50.900

Technical Details

HEA's net metering program is open to all retail members – any residential, commercial, industrial or other member who pays standard retail rates as opposed to having a special contract. According to the state regulations (Alaska Administrative Code, Chapter 50, Article 3), qualifying systems include solar PV, wind, biomass, hydroelectric, geothermal, hydrokinetic, ocean thermal, and landfill or biogas.[10]

Regardless of technology, individual net metered system capacity must be between 0.4 kW and 25 kW. Systems may be individual generators or groups, as long as the total installed capacity per meter does not exceed 25 kW.

As of May 2021, HEA's net metering program participation details include:

- **Technology Distribution:**
  - Wind turbines – 37, Solar PV – 373, Biodiesel – 1.
  - A few members have considered microhydro installations, but none have come online yet.
- **Capacity Range of Wind Turbines:**
  - 1 kW to 11 kW.
  - The most common turbine model in the program is the XZERES Skystream 3.7,[11] a 2.1 kW rated capacity unit.
- **Total Net Metered Wind Capacity:**
  - 120 kW.[12]
- **Net Metered Wind Turbine Voltages:**
  - All net metered wind turbines are connected to HEA's grid at 120/240 V.
- **Installation Locations:**
  - Most net metered installations are located at private residences with a few located at commercial businesses.

With few exceptions, most participants with wind turbines have only one turbine; however, several participants with wind turbines own other renewable generation assets as well. According to Cheatwood, about a third of program participants with wind turbines also have solar PV, and a handful have batteries connected to their wind and/or solar systems to provide uninterrupted power.

The generation capacity of small wind installations in the net metering program has remained fairly constant over the program's lifetime, with a few additions from members connecting existing off-grid wind turbines to the grid and then joining the program. No program participants have purchased or installed new wind turbines in the past few years. The net metering program growth is due to new member-owned solar PV installations. When the program started in 2010, there were 11 net metered solar PV systems and 26 net metered wind turbines. Ten years later, in 2020, net metered wind turbines had increased to 37, while net metered solar PV systems climbed to 294. See Figure 2. The number of interconnections is shown on the left axis; capacity in kW is shown on the right. The primary reason solar

[10] http://www.akleg.gov/basis/aac.asp#3.50.910
[11] https://www.xzeres.com/wp-content/uploads/2019/01/7246-Spec-Sheet-Domestic-Skystream-3.7.pdf
[12] The program does not have data on capacity factor of member-owned renewable energy systems.

PV has outpaced wind in this program is cost. In addition, the solar PV design and installation process in this area is easier for members. These and other factors are discussed in more detail throughout the report.

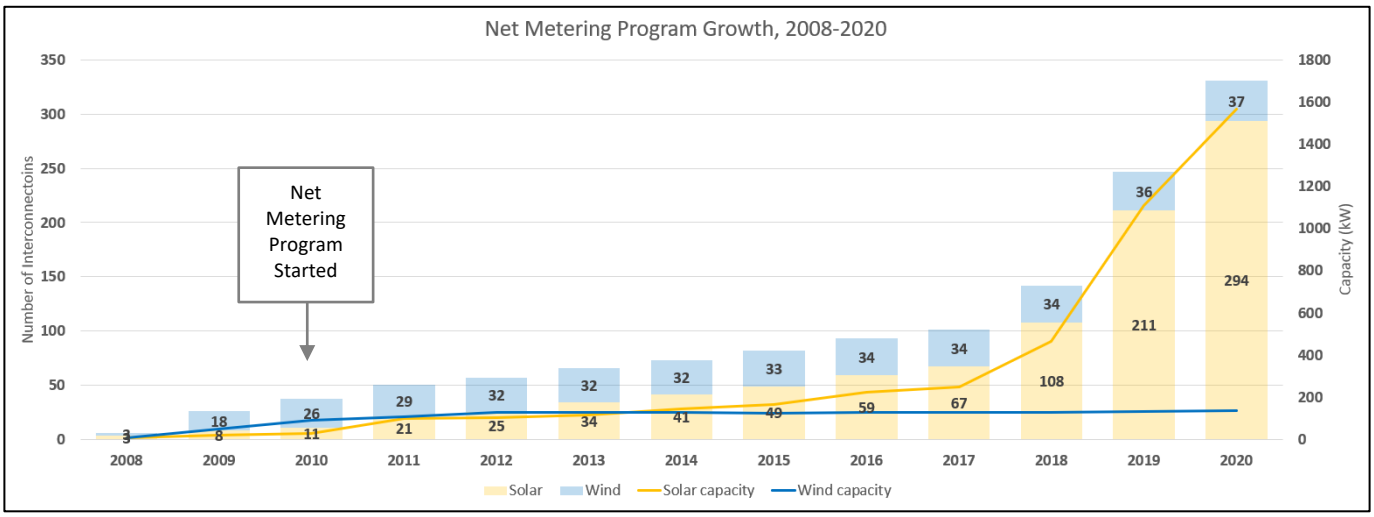

Figure 2. HEA Net Metering Program Interconnections and Capacity Over Time.
Courtesy of Homer Electric Association, 2021.

Siting and Interconnection

Net metered distributed wind systems are sited across HEA's territory at members' homes and businesses. To get approval for program participation, interconnection, and system energization, members and their installers must progress through a series of steps, which are explained in detail in the program's interconnection agreement, *Homer Electric Association Requirements for The Interconnection of Member-Owned Alternative Power Installations.*[13] These include:

- Submit an application, equipment specifications, maintenance agreements, and design drawings;
- Install the system after the application is approved;
- Pass inspections and/or tests performed by the member or HEA, at HEA's discretion, to determine if the system meets all required standards and specifications;
- Allow HEA to replace their existing meter with a bi-directional meter; and,
- Retest the system, if provided project documentation does not match the installed system.

After all steps are completed to HEA's satisfaction, the co-op will allow the system to be energized, and the member may then begin participating in the net metering program. Typically, there is no cost to the member from HEA for interconnection.

[13] https://www.homerelectric.com/wp-content/uploads/Interconnection-Requirements.pdf

Figure 3. Net Metered Wind Turbine at a Member's Business.
Courtesy of Homer Electric Association, 2021.

Metering

When the member's system is generating more energy than is being used on-site, their bi-directional meter spins backwards. When the member is using more energy than they are producing, electricity is supplied by the co-op and the meter spins forward.

Historically, HEA used Itron[14] bi-directional meters for the program, but the co-op is migrating to Aclara[15] meters, since Aclara is now HEA's automated meter reading (AMR) provider. The co-op's billing software, SEDC's utilityPOWERnet (UPN),[16] supports net metering, and HEA has not experienced any billing issues as a result of the program.

Production

In 2020, HEA purchased approximately 229 MWh of excess generation from all net metering program participants for just under $19,000. The co-op does not have insight into how much member-owned generation is used on-site. Members can see total system production from their inverter and/or system software, but this is not part of the co-op's metering infrastructure. Furthermore, the program does not disaggregate net metered production by time of day, since their retail pricing structure is a flat per kWh rate.

The net metering program's total installed nameplate capacity from all technologies was slightly more than 2 MW in 2020, which is approximately 4% of HEA's average retail demand. RCA regulations cap

[14] https://www.itron.com/na/solutions/product-catalog/electricity-meters-modules#sort=%40displayz32xname%20ascending
[15] https://www.aclara.com/products-and-services/smart-meters/
[16] https://www.sedata.com/home/software-and-tools-for-electric-membership-cooperatives-public-power-providers-and-municipalities/

installed capacity from net metering programs at 1.5% of each utility's average retail demand, but there is flexibility to this policy. Utilities may request a cap increase, as HEA has done twice. In May of 2019, HEA increased its cap to 3%, and in October of 2020, increased it again to 7% due to member interest in the program.[17]

According to Brad Zubeck, HEA's director of engineering, this level of net metered generation does not cause the co-op problems with power quality or overloaded distribution lines. The small individual system sizes mitigate potential grid impacts as well. However, HEA is mindful that issues may arise as the program approaches the new 7% cap and, therefore, has contingencies in place if needed. For example, if a member's system negatively impacts power quality on a co-op line, that member could be required to disconnect the system temporarily while a solution is determined.

Planning & Engineering

Members are responsible for their own system sizing and design and must follow requirements in the interconnection agreement.[18] In the program's early days, many members performed their own system design and installations, seeking guidance from the co-op along the way. Now, for both wind and solar, most members work directly with installer/electricians who are familiar with the net metering program requirements.[19] HEA's net metering program shares names of design and installation contractors who have successfully installed systems in accordance with program requirements, but the co-op does not have a preferred manufacturer, vendor program, or other formal program partnerships.

Based on local experience, wind turbine installers in the area require members to collect a full year of wind data using anemometers to measure wind speed, temperature sensors, and wind vanes mounted at potential sites as close as possible to the desired hub height. Consumer-level anemometers and wind vanes are readily available online for approximately $100 or less. Although the cost to acquire wind data collection equipment is generally not prohibitive, the year-long data collection requirement is a deterrent to some members. According to Alice Orrell, energy analyst at Pacific Northwest National Laboratory (PNNL) and lead author of the annual *Distributed Wind Market Report*, a year-long data collection process for small-scale distributed wind is not typical, because small wind installers have access to free and low cost wind speed resource data and tools that are sufficient for accurate system modeling in most areas.

Operations & Maintenance

In accordance with the co-op's interconnection agreement, net metering program participants are responsible for keeping their wind turbines in good working order and retaining maintenance records as proof. Beyond this program requirement, HEA is generally not involved with maintenance of member-owned systems.

This area presents a challenge to some wind turbine owners. Currently, there are few wind turbine maintenance technicians available to serve the co-op's territory. The few contractors who install small wind systems in the area generally do not perform maintenance. According to Cheatwood, one installer who has installed small wind turbines in HEA's area is located in Anchorage, 222 miles away. The eight-hour round trip drive, or 45-minute flight each way, is rarely justified by a maintenance call. This results

[17] https://www.akenergytransparency.org/news/hea-to-seek-10-net-metering-cap
[18] https://www.homerelectric.com/wp-content/uploads/Interconnection-Requirements.pdf
[19] For more information on small wind design considerations, see: https://windexchange.energy.gov/small-wind-guidebook

in some members "running them to failure," said Zubeck, rather than maintaining their wind turbines to optimize lifetime. Whether the lack of wind technicians is a cause or effect of the program's shift to solar PV is hard to say, but regardless, it creates a barrier to wind turbine ownership in this area.

Economic Details

Financing

Currently, members typically engage installer/electricians rather than the co-op early in the planning process. As a result, installer/electricians estimate costs and payback. As part of this process, many installers also help members navigate the federal[20] and USDA grants[21] that are available for member-owned renewable energy systems. Based on a review of program applications, Cheatwood estimates that over the past three years, about a quarter of program participants use federal tax credits to offset their systems' costs.

Power Purchase Agreements and Renewable Energy Credits

Program participants offset the amount of electricity they purchase from HEA with their own generation. At the end of each month, each participant's bi-directional meter provides a net reading for that month. Members who generated more than they consumed are compensated by the co-op for the excess generation at the Small Facility Power Purchase Rate (SFPPR), which varies quarterly and must be filed by the co-op and approved by the RCA. In 2020, the SFPPR averaged 8.419¢/kWh.[22] If a member uses more electricity than they generate in any given month, they are billed for their usage at their standard retail rate. For reference, the residential rate in 2021 is just over 16¢/kWh.[23]

In addition to the sale of renewable energy, large wind developments often add revenue to their projects through the sale of *renewable energy certificates* (RECs), also known as *renewable energy credits*. RECs represent the renewable attributes of green energy separate from the energy itself and are typically sold in increments of 1 MWh,[24] making them impractical for small wind deployments.

Members and Community

HEA's net metering program has a positive impact on participants, as evidenced by the program's growth to more than 400 participants. These members are reducing their electric bills by offsetting some or all of their energy purchases with renewable energy from their own systems.

Non-program participants and the broader community benefit from the increase in locally generated renewable energy, which can reduce fossil fuel generation in the region. Furthermore, the program supports jobs for local electricians and installers, as well as the community's general interest in renewable energy. An outgrowth of this community interest is a regional non-profit, unaffiliated with HEA, called

[20] https://www.energystar.gov/about/federal_tax_credits/renewable_energy_tax_credits#:~:text=Under%20the%20Consolidated%20Appropriations%20Act,those%20for%20solar%20energy%20systems
[21] https://www.rd.usda.gov/node/16860
[22] https://www.homerelectric.com/wp-content/uploads/Sheet-87.1-Effective-October-1-2020.pdf
[23] https://www.homerelectric.com/member-services/my-bill/rates/ Note that members also pay a separate charge for cost of fuel/power purchased.
[24] https://www.epa.gov/greenpower/renewable-energy-certificates-recs

Solarize the Kenai.[25] This group works to simplify the process of residential solar PV installations and reduce costs through outreach, education, and group-buy programs.

Lastly, HEA did not raise rates to cover the net metering program costs. Members who do not participate may enjoy some of the benefits of clean local energy or jobs, but they do not pay any extra on their bills. Going forward, Zubeck does not expect HEA's rate structure to be impacted by the net metering program, even as it continues to grow.

Project Experience, Opportunities, and Challenges

HEA's net metering program runs smoothly overall, and according to Zubeck, there are no significant impacts to the co-op's power purchases or power quality. But, the program has had to adapt to external factors. The most notable of these is that their members who choose to own renewable energy systems are moving away from wind and gravitating to solar.

Several factors are contributing to this shift, with price competition from solar PV being the most likely culprit. The Solar Energy Industries Association (SEIA) reports that prices for solar PV have fallen by about 70% since 2010. During this same time, prices for small wind turbines (<100 kW) have been relatively flat, but are generally higher than solar PV. This trend of declining deployment is not unique to HEA's members. The U.S. Department of Energy reported in its *2019 Distributed Wind Data Summary*[26] that sales of small wind turbines across the U.S. have been declining since 2010, when HEA's net metering program began. The co-op suspects that the year-long data collection requirement, coupled with the scarcity of maintenance technicians in the area, has contributed to the lack in recent wind turbine installations. Because HEA's net metering program is technology neutral, the co-op does not try to influence members to install one technology over another. Rather, the program seeks to accommodate members' expressed interests.

While the wind resource assessment and maintenance issues present barriers to small wind in HEA's area, individuals in other locations may want to check with their local installers for information on their system design process and maintenance options. Small wind turbine manufacturers may also offer support for system design, and some online tools that predict wind generation based on location are available directly to consumers. These tools include the free Systems Advisor Model[27] from the National Renewable Energy Laboratory (NREL), the subscription-based New Roots Energy[28] tool, and low-cost site assessment reports available for purchase online.[29] Free wind resource data are available from U.S. Department of Energy wind resource maps[30] and NREL's Wind Prospector tool.[31]

Wind Prospector relies on the Wind Integration National Dataset (WIND) Toolkit.[32] The WIND Toolkit is currently being updated by the U.S. Department of Energy's (DOE's) Tools for Assessing Performance (TAP) project "which aims to improve wind resource characterization, thereby reducing the uncertainty of project performance and financing costs, increasing consumer confidence, and lowering the levelized cost

[25] https://www.solarizethekenai.org/
[26] https://www.pnnl.gov/sites/default/files/media/file/2019%20Distributed%20Wind%20Data%20Summary-10Aug20.pdf
[27] https://sam.nrel.gov/wind.html
[28] http://www.newrootsenergy.com/
[29] https://dashboards.awstruepower.com/products
[30] https://windexchange.energy.gov/maps-data
[31] https://maps.nrel.gov/wind-prospector\
[32] https://www.nrel.gov/grid/wind-toolkit.html

of distributed wind energy."[33] The WIND Toolkit includes wind speed data from across the country and is in the process of adding new data for Alaska.

While small wind is likely to cost more upfront than solar PV, wind may be more cost-effective over time in some locations (particularly locations with stronger wind resources than solar resources, such as Minnesota), given its ability to generate electricity day and night, as conditions allow, and its increased potential for generation during the winter. Also, small wind turbines have smaller footprints than solar PV arrays of similar capacities, so that members who are unable to install PV on their rooftops may want to evaluate whether a wind turbine is a better option than ground-mounted solar. Finally, several participants in HEA's program own both wind and solar, which maximizes their generation potential throughout the day and night and during different seasons.

Key Lessons and Insights

Based on 11 years of running a successful net metering program, HEA offers some advice to other co-ops based on their lessons learned:

- **Manage Member Expectations**:

  When the program began, participants had frequent contact with HEA as they designed and installed their systems. However, as the program has grown, members more commonly work directly with third-party electricians/installers to design their systems, estimate performance, and predict payback. The co-op reviews system data as part of program applications, but it does not have the staff time to check all calculations and verify vendors' claims. This leaves open the possibility that a third-party vendor could set inaccurate performance or revenue expectations that may, unfairly, lead to member frustration with the co-op. Program participants should be advised to work with knowledgeable and reputable vendors. To the extent that the program has staff time and availability, direct engagement with members early in the program application process can help set realistic expectations.

- **Expect Seasonal Variability in Program Staffing Needs:**

  In HEA's climate, construction grinds to a halt during the winter. The impact to the net metering program is that the workload is concentrated in the spring and summer. In addition to reviewing applications, staff conduct site visits to inspect and test installed systems and switch out meters. This can lead to program staff being overallocated during the construction season, which makes it challenging to interface directly with all potential program participants. HEA advises other co-ops to anticipate their own seasonal staffing needs based on local climate.

HEA plans to offer the net metering program for the foreseeable future, but the program's fate is not entirely in the co-op's hands. As J.D. Draves, HEA's manager of regulatory affairs and rate design, explained, much of the net metering program's structure and timing was determined by the 2010 RCA regulations. It is possible that the RCA will update its rules in the coming years to align with market conditions at that time. One potential change on the horizon is the adoption of a renewable portfolio standard (RPS), which Alaska currently does not have. As the state evolves its energy planning, HEA will continue to adapt its net metering program and support members who wish to generate renewable energy at their homes and businesses.

[33] https://www.energy.gov/eere/wind/downloads/tools-assessing-performance-fact-sheet

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Additional Information on NRECA Research's RADWIND Project

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Want to stay informed of our progress with the RADWIND project, and provide your input and feedback? We welcome all NRECA members to join the project as an advisor. Contact our team at: RadwindProject@nreca.coop.