Oregon Army National Guard Net Zero Newsletter

ISSUE 4 JANUARY 2013

Geothermal Power Economics & Risk

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by FY20 Total Solar Renewable

315 KW

Energy Capacity Installed :

412,000 KWH/YR

Total Energy Produced per year

% toward NZ goal of

10%

20% Renewable Energy by FY20

In the last edition of the ORARNG Net Zero Newsletter we described our early stage look into developing a geothermal combined heat and power plant at Kingsley Field in Klamath Falls, Oregon. This article discusses economic rules of thumb and financial risks associated with geothermal power projects.

Renewable power and heat generated from geothermal energy reservoirs offers the potential for both Net Zero energy and energy security. A federal facility that taps into an adequate geothermal hot spot can enjoy electrical and heat energy from an inexhaustible renewable resource, achieve electrical grid independence and become insulated from future energy price increases and greenhouse gas emissions cost. Given these benefits, the potential value of geothermal energy is obvious. However, it is the technology's cost and financing risks that determine its viability.

Similar to other renewable energy technologies, geothermal power generation has high upfront costs and low long term operating costs compared to conventional fossil fuel power plants where the opposite profile exists. However, unlike solar or wind, long geothermal project development lead times coupled with the need to spend a large part of the initial investment on proving resource potential can create a high degree of financial uncertainty. This geologic exploration risk is largely responsible for the fact that geothermal power production in the U.S. provides less than 1 percent of the country's total generating capacity.

To illustrate the project risks as well as opportunities for risk mitigation, let's take a look at the development stages and potential costs of a small scale (5 megawatt [MW]) geothermal power plant. Let's assume the project will be developed on a site owned and occupied by a federal agency. Keep in mind that surface land rights do not necessarily extend to water and geothermal assets. Subsurface rights acquisition in some form may be necessary. Total development costs can equal or exceed $5000 per kilowatt of installed capacity.

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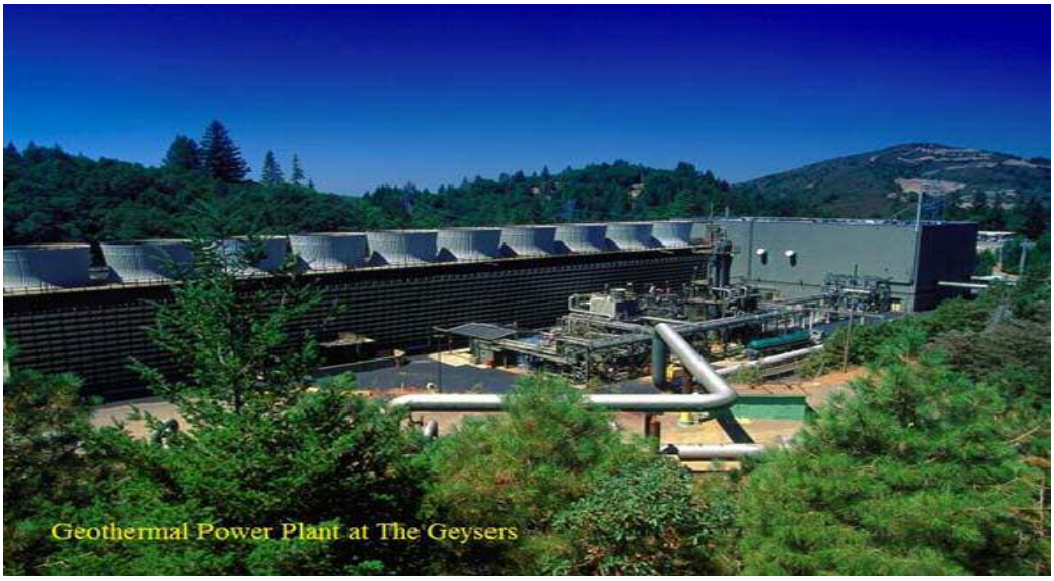

Geothermal Power Plant at The Geysers

Net Zero *Energy* Updates:

*Net Zero **ENERGY** Installations produce renewable energy equal to the energy consumed over the course of a year.*

The Assistant Secretary of the Army for Installations, Energy and Environment (ASA-IEE) has developed the Army's Net Zero Installation Strategy. The goal is for installations to reduce consumption, conserve resources and maximize renewable energy resources with the goal to be net zero, based on net zero energy, net zero water and net zero waste, all striving towards sustainable installations. We are creating a culture that recognizes the value of sustainability measures in terms of mission capability, fiscal sustainability, quality of life, local community relationships and preserving the Army's future energy security.

Christmas Valley Solar Project: Preparing for Power Purchase Agreement negotiations with the local utility for the 150 kW PV system installed in Phase 1. Meetings have been held with several developers and work has begun towards an RFP for Phase 2 development of PV in the range of 5 MW - 20 MW.

Camp Rilea Wave Energy Project: Wave energy development is primarily focused on the planning processes for defining areas of wave energy development. Camp Rilea has been identified as one of the proposed five to seven sites along the Oregon Coast This is being done at the state level for the Territorial Sea and at the federal level through BOEM, NOAA, and others for the Outer Continental Shelf. At the state level, development maps are expected to be completed in January 2013.

Resource Efficiency Managers (REMs): The REMs are identifying the potential for low– and no-cost energy conservation measures and has been instrumental in submitted ECIP proposals for biomass boiler installations and a Fort Oregon statewide lighting upgrade project. ORARNG was awarded a U.S. Forest Service grant of $250,000 for the design of biomass boilers at 5 sites. When installed, the new boilers will replace 176,000 gallons of propane with 940 tons of locally produced wood pellet fuel and an estimated savings of $170,000 per year.

Energy Engineering Analysis Program (EEAP): Energy audits conducted by USACE Huntsville, MCFA and EBL Engineers have been completed and final audit report submitted for the Camp Rilea and Salem area facilities.

Wind Energy Project at Camp Rilea: A met tower installation for Camp Rilea is being put out to bid. The intent is to gather 12 to 18 months of data to be prepared to install medium size wind turbines not to exceed the 239 ft tip height limit AMSL as defined by the FAA.

Polk County Readiness Center: The new COL James W. Nesmith Readiness Center was dedicated on 12 October 2012 and includes a 36 kW rooftop solar PV system. The Readiness Center earned a LEED Gold facility rating and is projected to have an EUI of under 30.

Camp Withycombe Lighting Projects: A comprehensive lighting upgrade of interior and exterior spaces at Camp Withycombe, estimated to reduce energy consumption annually by 700,000 kWh, is in design. In addition, the Oregon Military Museum, a former armory, will receive new high efficiency lighting, including an LED track system in the main exhibit hall.

The Dalles Readiness Center: Contract was awarded and construction has begun. A minimum of 50 kW solar PV is planned but the final installed capacity will likely be larger. A number of energy upgrades such as a ground source heat pump and increased insulation are being programmed into the design made possible primarily through a partnership with Columbia Gorge Community College and some state funding. The goal is to make this our first Net Zero Energy Readiness Center.

Geothermal Energy Development: Geothermal energy resource assessment for the potential of geothermal power production are ongoing at Christmas Valley and Kingsley Field in Klamath Falls.

Net Zero *Water* Updates: Camp Rilea Net Zero 2020

Oregon National Guard Vision

The Oregon Army National Guard (ORARNG) is committed in continuing to advance Camp Rilea as a Net Zero Water Installation. ORARNG adopted and implemented core components of this objective as early as 1978 with the design and implementation of its Wastewater Treatment Plant and effluent beneficial use with aquifer recharge. ORARNG has taken a holistic strategy in continuing this advancement to balance benefits and costs with strong efforts to limit water consumption and return it back to the original watershed.

Oregon National Guard Objectives

- **Foster a Sustainability Ethic**
- **Strengthen Army Operations**
- **Meet Testing, Training, and Mission Requirements**
- **Minimize Impacts and Total Ownership Costs**
- **Enhance Well-Being**
- **Drive Innovation**

The Oregon Army National Guard has taken the water supply at its Camp Rilea training site off the grid.
With a new water recycling facility and basins that return treated water to an underground aquifer, the Warrenton facility is working its way toward net zero water. The idea is to continually recycle the water used on site to preserve local water resources. "It reduces our demand on the freshwater aquifer," said Jim Arnold, an environmental restorations manager with the Oregon Army National Guard. "If we take 5 gallons out and recycle 4 gallons, we're only having to continually pull one gallon out. We're pulling water out of the aquifer, but we recharge that same aquifer we took it out from." To move closer toward net-zero water - recycling all of the water it uses - Camp Rilea is also working on water efficiency and conservation plans. A water balance study showed 59 percent of the water use on the base comes from domestic plumbing - showers, sinks and toilets. The kitchen uses 18 percent of the total, irrigation uses 10 percent, vehicle washing consumes 3.6 percent and laundry takes 3.4 percent. The site will reuse its own treated wastewater for irrigation, laundry and vehicle washing. Water pulled from the aquifer can go to an on-site treatment plant to bring it up to drinking water quality. "At Camp Rilea we can operate off the grid," Arnold said. "The new system allowed us to sever our tie to the municipal supply. Instead, we have a water supply system that draws water from the aquifer that we sit on through water withdrawal wells, treats it to drinking water standards and distributes it through our channels." Arnold said even before the net-zero initiative, the water used at Camp Rilea didn't even make a dent in the local aquifer. But the pilot project will help demonstrate techniques that other military sites can use to reduce their water footprints.
The project is part of **a much broader initiative** at 19 Army sites across the country that targets net zero energy, water and waste. The Oregon Army National Guard volunteered to try for net zero energy at all 40 of its installations across the state. Numerous solar projects and possible wind, wave and biomass energy projects are in the works to achieve that goal. The military has been treating its own water and reusing it for irrigation at Camp Rilea since 1978. The net-zero water program enhanced that process by adding a water recycling plant and "rapid infiltration basins" that send more treated water back to the aquifer, 200 feet underground. "It's a closed-loop process," said Arnold. "Whatever we take out we put back into the aquifer. We added a recycled water plant to treat that water to the point where it's usable for other purposes on the post. We can use it for anything except drinking and filling a pool."
John DeVoe of Oregon Water Watch said to be truly net zero, the military will have to put more water back into the aquifer than they take out to account for evaporation and consumption of the water used on the site. Arnold said the new rapid infiltration basins are designed to reduce the amount of water that evaporates using spray irrigation. "If you look at the army's net zero definition," he said, "it calls for us to use the water from the aquifer that we sit on, use it efficiently, and return it to the same watershed so we're not depleting the surface water resources in that region."

ENERGY SAVINGS PERFORMANCE CONTRACTS

SITUATION:

This Net Zero Newsletter shares great ideas and projects, but how do we get them funded? An energy savings performance contract can provide substantial benefits to the Oregon National Guard to fund projects without the need for upfront capital.

As part of the Army pilot program, our organizational goal is to be net zero energy by year end 2020. To meet that goal, the Oregon National Guard needs to reduce our energy consumption by 65 percent from baseline year fiscal year (FY) 2003. That's a healthy challenge considering the current state of federal and state budgets. Combine the budget woes with an aging facility infrastructure, and the challenge appears daunting.

WHAT IS ESPC?

A significant part of the solution may lay with the use of an Energy Savings Performance Contract (ESPC). ESPCs allow state agencies to accomplish energy savings projects without upfront capital costs or special funding appropriations.

An ESPC is an agreement between an energy services company (ESCO) and a building owner. Oregon defines ESPC as "a public contract between a state agency and a qualified ESCO for the identification, evaluation, recommendation, design and construction of energy conservation measures, including a design-build contract, that guarantee energy savings or performance." At its core, an ESPC is a "design-build" contract with some highly tailored specializations. The owner uses the energy cost savings to pay off the loan that financed the energy conservation projects. The ESCO guarantees that the improvements will generate energy cost savings sufficient to pay for the project over the term of the contract.

HOW DOES IT WORK?

After you enter into an agreement with a private ESCO, it will identify and evaluate energy-saving opportunities and then recommend a package of improvements to be paid for through savings. The ESCO will guarantee that savings meet or exceed annual payments to cover all project costs - usually over a contract term of 10 to 15 years. To ensure savings, the ESCO offers staff training and long-term measurement and verification services.

Many types of building improvements can be funded through existing energy budgets –energy management systems, interior and exterior lighting, boiler/chiller replacement, repair of hot water distribution systems, high-efficiency HVAC systems or any other system that's fits within your financial criteria.

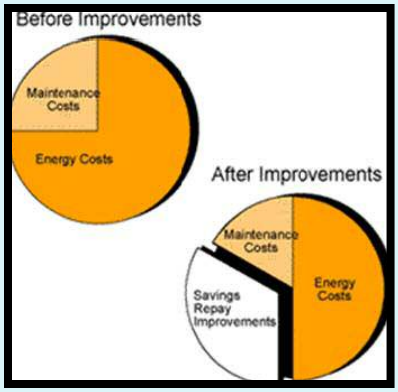
ESCOs typically work under a performance guarantee that shifts the risk **to** the ESCO. The ESCO provides guaranteed project cost, guaranteed savings, and guaranteed equipment performance. Your guaranteed energy savings pay for the upgrades, so you have no upfront costs. If energy savings don't materialize, the ESCO pays the difference, not you.

WHAT IS THE BENEFIT TO THE GUARD?

Energy savings performance contracts help the Oregon National Guard meet energy efficiency, renewable energy, and water conservation reduction goals by streamlining contract funding for energy management projects. The streamlined process provides multiple benefits, including:

1. Increased quality and value through:

- Access to private-sector expertise in energy efficiency, renewable energy, water conservation, and reduced emissions
- Built-in incentives for ESCOs to provide high-quality equipment, timely services, and thorough project commissioning
- Infrastructure improvements to enhance mission support
- Healthier, safer working and living environments
- Flexible, practical contract and procurement processes to ensures our project, our way



2. Smart project management that:

- Ensures building efficiency improvements and new equipment without upfront capital costs
- Funds energy improvements without relying on special appropriations
- Guarantees energy and related operation and maintenance cost savings
- Enhances the ability to plan and budget energy, operation, and maintenance accounts minimizes vulnerability to budget impacts due to volatile energy prices, weather, and equipment failure.

CONCLUSION: When executed correctly, an ESPC can have many advantages over traditional contracting methods. From a taxpayer perspective, an ESPC used by the Oregon National Guard can provide a vehicle to quickly achieve substantial energy savings with limited fiscal or budgetary impacts - because large projects are financed via energy savings, not the capital budget. An ESPC is a powerful arrow in the quiver that moves the Oregon National Guard closer to achieving our net zero energy goal.

Energy Conservation

Have you gone LoCo?

Easy there big fellow! You talking to me?

I make a call and pretty soon some 105's start dropping around here real quick!

Relax Gunny! Not loco crazy, LoCo as in Low Cost/No Cost. LoCo is the new term for ***Low Cost/No Cost energy conservation measures.*** LoCo does not, strictly speaking, include the "No Cost" aspect. But to keep things simple, we are going to accept the new lingo. Now LoCo could be considered low hanging fruit in some cases, but not exactly this type of low hanging fruit. LoCo measures are important because they result in real time energy savings and value. Let me give you three examples of LoCo energy conservation to make my point.

We have a large warehouse that is heated by gas-fired unit heaters hanging from the ceiling. Currently, the heat runs 24/7 during the heating season at 70°. By simply converting to programmable thermostats, the heaters will be setback to 58° after working hours and on weekends. The savings will pay for the project within two months while saving $1,082 per year per thermostat! LoCo!

During the Veterans Day Holiday, I reviewed numerous sites and discovered that a 100 horsepower air compressor servicing multiple types of equipment was running. In fact, it had run the whole weekend. Shutting that compressor off for the Veterans Day Holiday would have saved $391! Let's extrapolate that and conclude that if the compressor is diligently shut off for 12 hours per day plus weekends and holidays, the Oregon National Guard would save $5.43 per hour or $30,599 per year. Policies are now being written to ensure that the compressor only runs during occupied times. LoCo!

Here's another easy fix. An older k-style armory drill hall was built with a 24 inch square louvered vent in the roof. Obviously, when it got hot during the summer, the attached chain was pulled and the vent opened releasing trapped hot air. However when I visited the armory in the dead of winter, I looked up at the ceiling and saw beautiful blue sky through the open 24 inch vent. I followed the chain, reached up and pulled on the chain, and the blue sky disappeared. I did not calculate the savings but it's pretty clear that we were blowing heat right out of a 24 inch hole in the roof. LoCo!

The best approach to developing LoCo's is a knowledge based approach.
Here are a few thoughts for you Readiness NCO's and State maintenance workers. Know your buildings, their mission, processes, deficiencies, schedules and needs. Know your people, in the buildings, in the shops, utilities, and throughout the whole site. Don't be afraid to ask a little three letter question - "why"? Why are we doing this this way? Why is the heat on when the overhead doors are open? Why do we keep this machine warm when it is only used one a week? There may be a valid reason, but its common sense to ask "why"?

Many LoCo's are brought to the Energy Team from site personnel. The compressor issue described above was brought forward by a maintenance worker asking - why? Another State maintenance worker was experiencing a high failure rate of compact fluorescent lighting in his drill hall costing the Guard $1,200 per year. The Energy Team is searching out a cost effective solution.

A walkthrough of armories showed that many fitness centers have the heat jacked up and the lights left on. LoCo! Many times as I walk around the larger Readiness Centers, unoccupied conference room lighting is left on. Turn the lights off as you walk by. LoCo!

The sustainability culture the Oregon National Guard envisions is one in which every member of each installation carries out their duties with full consideration for energy and water efficiency, minimizing waste and emissions to the environment and the cost of doing business. Business as usual is no longer acceptable. To create such a culture will be an enormous undertaking, but with your help we can do it.

We are continuing to invest in capital energy efficiency projects and are seeking funding for our energy management programs but what we urgently need is a behavioral "ground swell" to create a culture of sustainability across the Guard.

Please contact LTC Safe, Kenneth.Safe.mil@mail.mil or Larry Hamburg, Larry.J.Hamburg.ctr@mail.mil on the Energy Team with any suggestions or input. Let's get **LoCo!**

Geothermal Power Economic & Risk cont

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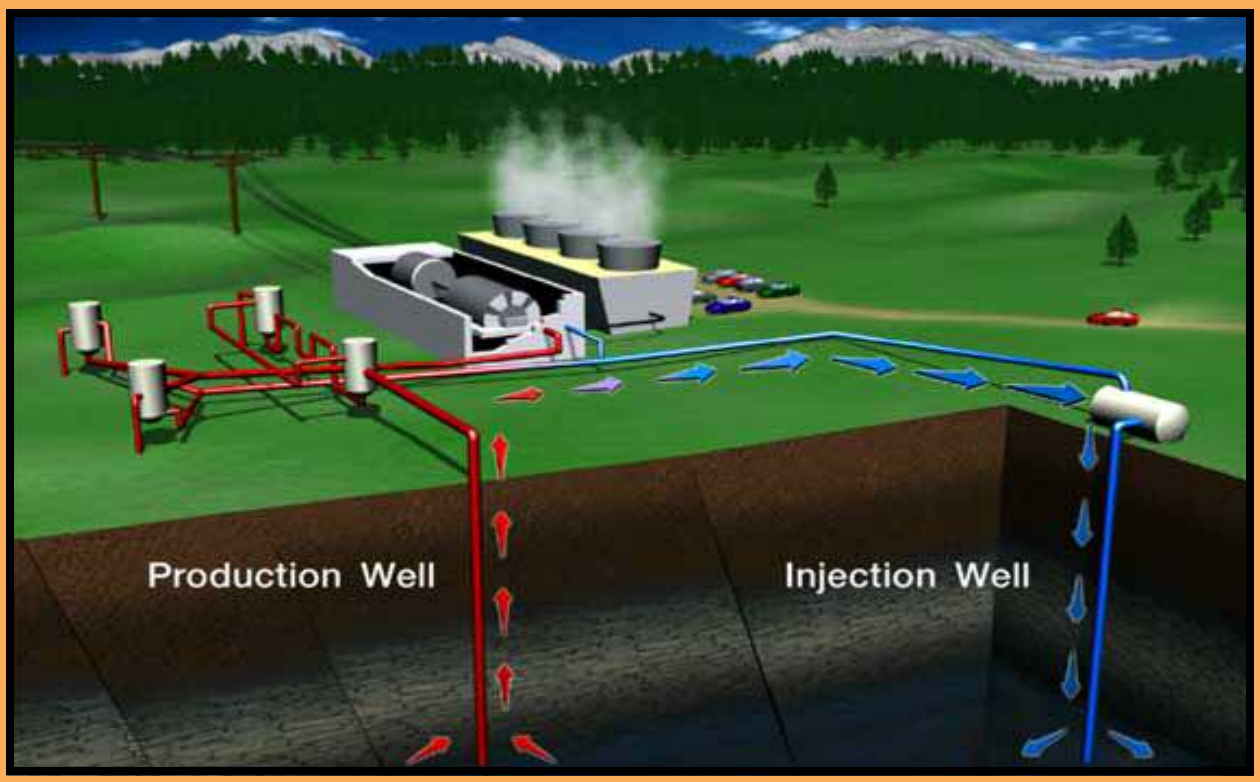
The first stage of geothermal exploration uses relatively non-invasive geophysical survey techniques to characterize geothermal temperature gradient, flow rate and reservoir location. Improved technology, such as better survey data accuracy and interpretive software would help lower the percentage of unsuccessful exploratory drilling (as high as 75 percent) and its associated cost. The survey stage can take 2 years and use 5 percent of development costs whereas the next stage - exploratory drilling –can consume 60 percent or more of the costs in about the same period of time. Obtaining financing when the odds of success are so tenuous represents the greatest challenge to geothermal project development.

The power plant design, construction and commissioning phase can commence once an adequate hydrothermal reservoir is located and production and injection wells are drilled. Expect this phase to require 2 years and 30 to 40 percent of total costs. Additional expense should be planned for environmental assessment, utility interconnection study and electric grid connection infrastructure.
The resulting power plant operating at full capacity will generate electricity at a cost of $0.08 to $0.12 per kilowatt-hour given the above project development costs. Alternatively, it may be possible to work with a third party developer that accepts the development, ownership and investment risks and provides energy under a long term Power Purchase Agreement (PPA). The energy price will then be determined by the developer's costs and margin, utility payment for purchase of excess generation and the value of renewable energy credits (where applicable). Ideally, geothermal power under the PPA will be provided at a discount to the retail rate, stable over the contract term and guaranteed in regard to availability.

According to the U.S. Geological Survey, the potential exists to increase U.S. geothermal power from 3,000 MW to 40,000 MW using existing technologies, largely because of the western states' alignment with the Pacific Ring of Fire. As exploration technologies improve and development costs and investment risks trend lower, geothermal energy and the benefits provided by firm renewable power generation will experience much greater adoption.



Redmond Armory Stays Cool Under the Sun

Installing solar photovoltaic or PV power can be done in several ways to facilitate reaching the Net Zero Energy goal. The most obvious application is the utility scale PV farm, which provides numerous benefits including the option to use a third party developer who finances, owns and operates the PV asset. On the other end of the scale, PV can be exploited in the way it has been used since the early days of the technology - to power small discreet electrical loads. At its armory in Redmond, the Oregon Army National Guard contracted with Northwest Renewable Energy Corp (www.nwrec.us) to install their SunCooler product, a roof ventilator using a DC motor and fan powered by an integrated PV module.

Two existing ventilators on the armory drill hall roof were retrofitted with SunCoolers, using the existing curbs and roof flashing. The units are operated by a circuit interlocked with the existing ventilator air damper control that is wired to a toggle switch within the building. The ventilators are used during the day as needed to exhaust excess heat at ceiling level. After 6 months of operation, the SunCoolers have done that job well, each exhausting air at a rate of up to 2500 CFM while consuming no electricity.

The SunCooler is made from U.S. parts assembled in Oregon. In addition to heat extraction, models are available that provide air destratification, thermal balance with fresh air and fresh air night flush with either hard-wired or wireless Bacnet compatible con-trols.

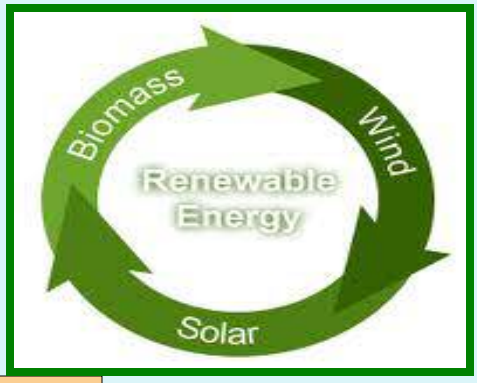
Enabling Through Legislation

The Oregon Military Department (OMD) is committed to a long-term clean energy development program. This activity primarily supports the Energy Security initiative of the U.S. Department of Defense (DOD), and in particular the Army's Net Zero Installations program. DOD will depend on National Guard units across the country to provide some of their goal of 3000 megawatts (MW) of renewable energy generating capacity. It's the intent of OMD to remain a leader in clean energy development for years to come. OMD's clean energy development program serves multiple State government missions such as the State's 10-year energy plan and goals of the Oregon Department of Energy. The program provides benefits to the people of Oregon in the following ways:

- support high-quality military training for Oregon National Guard and Reserve soldiers;
- enhance OMD's participation in state and national emergency management programs;
- advance Oregon energy policy by accelerating the construction of utility-scale renewable energy facilities;
- promote economic development in Oregon by stimulating business development opportunities for the state's clean energy industry and by creating jobs in local communities; and
- support clean energy research, education and training in Oregon.

Legislation can be a key enabler towards meeting this goal. With 55 Oregon National Guard sites and 17 utilities supporting these sites, the situation is in stark contrast to a typical Active Component Installation with one utility provider. Generally speaking there are four good renewable resource sites on OMD property where utility scale electricity can be produced. However, most of the Readiness Centers throughout the state don't have direct access to these RE sites. There needs to be a way to virtual net meter energy across the state.

Utilities in Oregon are not required to offer a standard service option that is designed to supply renewable energy to commercial and industrial customers. Furthermore, existing state policies do not provide the flexibility that large customers need to buy renewable energy in the competitive marketplace. OMD would directly benefit from a standard utility service that enables large consumers to self-supply renewable energy for their operations. OMD could indirectly benefit from such a service by forming renewable energy development partnerships with other large consumers of electricity in the state, possibly including energy-intensive data centers.



OMD is proposing legislation for the creation of a hybrid of virtual net metering (VNM) and feed-in tariff (FIT) business practices that will enable large consumers of electricity to self-supply renewable energy for their Oregon operations. If successful, this will enable OMD to be the off taker of renewable energy at multiple facilities throughout the State that is produced on a limited number of OMD sites where the resource is best and where there is adequate space to develop that resource.

ORARNG Points of Contact

Deputy Director, Oregon Military Department
BG Michael Caldwell 503-584-3985

Director of Installations
COL Christian F. Rees 503-584-3871

Planning & Programming Interim Branch Chief
Net Zero Energy Project Lead & CFMO
LTC Ken Safe 503-584-3503

Environmental Restoration Manager
Net Zero Water Project Lead
Mr Jim Arnold 503-584-3551

Oregon Military Department
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