Appendix D: Guide to Farming Friendly Solar

With the proliferation of solar energy generation throughout Vermont, interest in on-farm solar generation has grown. For many communities, this has raised concerns about loss of valuable farm land and impacts to the visual landscape.

Local planners can protect primary agricultural soils (often referred to as "prime ag") and the working landscape as a matter of town policy by acknowledging and promoting on-farm solar and active agricultural use on the same land.

For the farmer, a properly designed solar project can deliver electricity and/or income while supporting local efforts to preserve agriculture and move the state toward its energy goals.

Why Farm-Compatible Solar?

Farms use a significant amount of energy, including diesel fuel for tractors and trucks, heating oil and/or propane for buildings, water heaters, and greenhouses, and electricity for refrigeration, lighting, and ventilation. Dairy farms use a lot of electricity, especially for cooling the milk and for ventilation.

For farms seeking to reduce expenses, generating electricity on the farm is appealing. Additionally, the possibility of a steady income stream for electricity generated beyond what the farm uses can be an important economic asset.

Important Consideration for Farmers

While solar can be an excellent opportunity to generate income, and reduce electricity costs, there may be more cost-effective efficiency improvements that should be considered a priority. For dairy farms, collecting, cooling and shipping a high volume of product is energy-intensive. In addition, keeping barns lit and properly ventilated adds to energy use. Installing equipment that will reduce energy use, such as a plate cooler or a heat-recovery unit, can significantly reduce energy expenses.

Solar is not the only option available to farmers. Depending on location, a farm might find that wind generation is possible. Wind turbines have a smaller footprint than solar, for the same amount of energy generated. Farm-scale turbines come in a variety of sizes. On the small end, a wind turbine can generate enough electricity for the equivalent of two or three homes. A larger turbine can generate enough for a 100-cow farm.

More than Just Solar

This document focuses specifically on solar energy generation that's designed to be compatible with continued farming, whereby little or no land is taken out of production. Despite this focus, it should be recognized that there are other forms of on-farm generation that may be even more suitable for some agricultural operations. In addition, there are significant opportunities for on-farm efficiency improvements. Vermont Farm to Plate has analyzed food-system energy issues, including on-farm generation and efficiency. For more information go to

http://www.vtfarmtoplate.com/plan/chapter/4-6-food-system-energy-issues.

Sheep Grazing, Open View Farm

Solar on Conserved Land

Conservation easement holders address solar in their guidelines. Generally, they support solar meeting up to 100% of the farm's usage, however they also provide guidance as to the footprint of the solar both as a percentage of the land base of the farm and as a total acreage. They may also recognize the potential for agricultural activity to occur within a solar facility. It stands to reason that the holder(s) of the farm's conservation easement would look more favorably on a request to approve solar if the agricultural usage was an inherent part of the proposal.
Contact your easement holder to get their guidance document and to give them an idea of your potential project.

For larger farms, a methane digester may also be a viable option, although the financial investment in the equipment needed for generation using manure can be significant.

Before considering solar, farmers should check the ramifications of where a facility is sited. First, if the farm is located on conserved property, the land trust that holds the easement will need to confirm that renewable energy generation is allowed under the easement, particularly if over an acre of land is being dedicated to generation.

Second, the Current Use Program, has specific criteria (see inset on next page) regarding solar on lands enrolled in the program.

A 150kW system with 572 solar panels, utilizing a south facing roof on the Ayers Brook Goat Dairy in Randolph, VT. Photo Source: Aegis Renewable Energy

Important Considerations for Local Planners

When considering specific policy related to on-farm solar installations, the obvious focus is on soil types. Primary agricultural soils are those defined as having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops[1] . Because of the value of these soils from a productivity standpoint, it is generally desirable to protect them from uses that would otherwise remove them from agricultural use.

Preference should be given to solar installations that utilize existing structures (such as the rooftop solar installation at the Ayers Brook Goat Dairy in Randolph – pictured on previous page). Rooftop solar is only viable on a south-facing roof when the structure can bear the weight of the system. For ground-mounted solar projects, local planners should understand that not all land being actively farmed includes primary agricultural soils. Communities developing policy around solar projects may want to identify a preference for ground mounted systems to be located on low quality soils when possible.

Finally, as is illustrated in the case studies on the next few pages, farming-friendly solar is possible. In our examples, several

1 These soils are protected in Vermont statute, where they are defined in Title 10 (10 V.S.A. § 6001) as "An important farmland soils map unit that the Natural Resources Conservation Service of the U.S. Department of Agriculture (NRCS) has identified and determined to have a rating of prime, statewide, or local importance…" The USDA NRCS provides maps on-line via the "Web Soil Survey." Soil maps are also found in the Vermont Agency of Natural Resources on-line maps.

farms have married on-farm solar with rotational grazing of livestock. Another has located their solar system in a buffer area required as part of their organic certification. As planners, it is important that we do not simply reject the concept of solar on farms or farmland out of hand. Instead, we need to consider how these systems can benefit our farmers and how they can be utilized in conjunction with active farming to achieve our energy goals and protect the viability of agriculture in our communities.

Solar and Eligibility for Current-use Taxation

To be eligible for use-value appraisal (the "current use program"), a solar array must be owned or leased by the farmer, with half or more of the electricity used on the farm. The land on which a solar array is placed cannot be enrolled in current use unless the facility itself is eligible – to be eligible, the solar facility must qualify as a "farm improvement," as defined in Vermont law (32 V.S.A. § 3752(14)) – essentially the two criteria stated above. By the same token, a solar facility that is not eligible cannot be located on land enrolled in the current use program. If the land is in current use prior to the installation of a solar project, and the solar facility will not qualify as a farm improvement, the landowner must pay the land-use change tax to take the land out of the program.

The overlapping requirements of the solar property tax exemption and the current use program provide a twist – please review the details on page 2 of the Tax Department's Technical Bulletin TB-69. It can be found here: http://tax.vermont.gov/research-and-reports/legal-library/technical-bulletins, and more general information on the current use program can be found here: http://tax.vermont.gov/property-owners/current-use, including removing your property from current use and paying the land-use-change tax.

Solar array in the buffer zone at the McKnight Farm

On Farm Solar: Case Studies

Seth Gardner – McKnight Farm, East Montpelier

Medium sized organic dairy farm

A solar array of 416 panels provides 120,000 kilowatt-hours (kWh) electricity annually – which supplies nearly all he needs for the farm –the primary purpose for choosing to install the structures.

Seth chose to take advantage of his location and the incentives provided at the time for putting up a solar array on his farm. Catamount Solar built the array on 1.5 acres of land that is a buffer zone between his fields and a non-organic neighbors' field. The land is rough with large areas of exposed bedrock.

"I was fortunate to have this spot – I needed a buffer between me and the next farm as I am organic and he is not. I was lucky in that it was close to the existing power line. It was a good use of land that I could not use otherwise" explains Seth.

Sheep hanging out, using the solar array as a refuge from the heat on a hot day- Open View Farm

Seth believes it is a good idea to combine solar panel arrays and farms – if there is good thoughtful planning beforehand. Siting is the biggest challenge he says, and it doesn't make sense to put these on the prime farmland, but rather to seek out the least intrusive places that can reasonably support the structures and are near three-phase power lines. He points to a barn or building roof as ideal if the structure is adequate and the roof is well-exposed to sunlight. In Seth's case, utilizing land that cannot be part of the farm production, is also an ideal spot. He is adamant that the farmer be involved with all stages of the project, including siting, construction, and payback schedules and receive full benefit of hosting a solar array on their farm.

Anna and Ben Freund – Open View Farm, New Haven

Diversified farm – maple, organic sheep and vegetables

Anna and Ben Freund operate Open View Farm on land leased from Winooski based Crosspollination Inc. The farm is home to a 2.49 Megawatt DC solar array, which produces enough energy annually to power 350 to 400 homes. From the beginning, one of Crosspollination's project goals was to incorporate sustainable energy with sustainable agriculture and have sheep graze within the solar array, mitigating the need for the grass beneath the panels to be mowed regularly, while providing prime pasture for sheep.

The original project design had the array spanning 40 acres with the intention of leaving enough space for haying equipment to pass between the rows of panels. That plan was revised and groSolar built an array compressed onto 17 acres, which still allows for maximum solar capture.

Once constructed, a woven wire fence was placed around the entire array. The disturbed ground beneath was seeded with a sheep-grazing mix, with some additional birdsfoot trefoil and clovers added as it is a clay type soil that dries out quickly in late summer if there is no precipitation. Anna has noticed that the bees also benefit from the clover blossoms in the solar array, especially after the surrounding hay has been harvested.

Anna and Ben partition the acreage inside the fence for a rotational grazing system, aligning their fences with the rows of solar panels. Anna says," We aim to have the

Forage and shade opportunities are good under Open View Farm's Solar Panels

sheep in the array during the hottest part of the summer and again in late fall. The panels provide a huge amount of shade, which the sheep appreciate and the array provides a stockpile of feed when other areas of the farm are being hayed. We also use the array as a secure place for the sheep to be on the rare occasions that we leave the farm to a sitter ".

The array has worked well as part of the sheep grazing system and the arrangement that Anna and Ben have with Crosspollination Inc. has allowed them access to farmland and infrastructure to establish a farm business. Until Crosspollination purchased the land, there had not been farm animals on the premise since the late 80's when the previous owners sold their dairy cattle.

Anna feels there are a lot of positives for having solar panels on farms – such as the clean renewable energy source they provide, and the economic benefits. Anna believes that the siting process must be thoughtful and deliberative to be most practical, and useful. Each site has variables to contend with, and each will need careful consideration.

Greg Hathaway – Maple Ridge Meats, Benson

Beef and Solar Enterprise

Hathaway Farm formerly operated as a dairy. Greg Hathaway, grandson, decided he wasn't interested in dairy, but wanted to raise beef cattle and has created a commercial slaughterhouse at the farm. As Maple Ridge Meats, the Hathaway's raise 250 head of beef cattle on their 650-acre farm. They process their own beef and provide the same services to producers from all over New England.

Greg thought it prudent to include alternative power generation as second revenue source for the farm. He investigated several solar developers and decided on the Green Lantern Group, based in Waterbury, VT. Working with Sam Carlson of Green Lantern Group, a 500-kW ground-mounted, group-net-metered solar array was installed over five acres, on a portion of land that has a Vermont Land Trust easement. Maple Ridge Meats will receive a monthly rental fee from Green Lantern.

This is first instance of grazing beef cattle under solar panels in Vermont. Greg says "Since [the array] has to be fenced, if that area was not grazed, it would be wasteland. So it really makes sense to have animals graze beneath the panels."

Greg plans to use the area with panels for cows during calving season. It's close to the barn and provides some shelter – yet open air for animals. Then once they are moved

Still to be seeded down before cows come- Maple Ridge Meat

on, he will use the area for yearlings to graze. The animals are smaller, so that will help in handling them while learning how to manage cattle within the solar array.

Greg feels very strongly that all ideas should be thought through and discussed before embarking on a solar array project. "The farmer knows the land and probably has a good idea of how they want it used. You also have to think about whether the income from this will offset the loss of that land. And whether the array is to be set up for machinery to pass through too or clustered closer together – but then losing some ability for vegetation to grow beneath due to being shaded out. Lots to think about."

Conclusion

All of these farmers were pleased with the arrangement they had made for the dual purposes of grazing and providing land space for solar panel arrays. Yet each one of them also mentioned a deep commitment to preserving the best agricultural land for agricultural uses first – and thus the common refrain of thinking it all through before any breaking of ground.

The structures are large and change how the land is used. All encouraged the idea of using lower-impact places such as a roof or land that cannot be used for agricultural purposes, first. And secondly, the importance of a revenue source to the farm/farmer for the use of that land supporting the solar array.

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