Every hour, more energy from sunlight strikes the earth than the entire human population uses in a whole year. Among the variety of technologies that take advantage of this abundant solar energy, photovoltaic (PV) systems hold promise for Maryland's farms. The quality of available light provides the potential for producing approximately 4.5 to 5 kilowatt hours per square meter per day, giving Maryland a mid-range solar potential. Five of the 2015 Kathleen A.P. Mathias Agriculture Energy Efficiency Program grantees harnessed that potential to realize energy savings in a wide range of farming environments.

A meat production farm, a horse farm, a poultry farm, a grain production farm and a goat cheese production farm installed PV systems ranging in size from 22,000 kWh to 99,000 kWh. The systems either generate an operation's entire electricity use, or part of the electricity use for a year. The electricity use on these farms ranged from 46,000 kWh to 178,000 kWh per year. The average cost for installation of the PV system was $2.42 per kWh and the average payback period for the PV systems installed was about 21.4 years, which is less than the 25 year expected useful life of the systems.

Solar PV systems must be sized appropriately for the site conditions and the needs of the farm. On Sarfraz Family Farm, a 69,300 kWh PV array powers a poultry operation.

This 99,000 kWh solar array is mounted on the horse arena roof at Swiss Dale Farm.

"The financial support received through Maryland's Mathias Ag Program was extremely helpful and shortened an already favorable return-on-investment for us. We would do it again, and strongly encourage other businesses to make similar commitments to renewable energy and sustainable manufacturing."

- Michael Koch, FireFly Farms

This 31,000 kWh solar array mounted on the barn roof powers grain production at Windridge Farm.

This 30,866 kWh solar array mounted on a creamery and market roof at FireFly Farms powers a goat cheese production farm.

The first step towards reducing energy use on a farm is to conserve energy by doing things such as weatherizing and reducing the amount of time the lights are on. The next step is to upgrade to more efficient equipment; incandescent light fixtures, for example, are replaced with more energy efficient LED light fixtures. The last step is to generate electricity through measures like a solar PV system. The grantees who installed solar PV systems through the Mathias Ag Program also replaced current inefficient equipment and installed energy efficient equipment to allow the solar installation to be more cost effective. When conserving energy through efficiency upgrades paired with renewable installations, the aggregated payback period is quicker. The more cost-effective energy efficiency measures that are installed the lower the overall simple payback period.

The following table summarizes the savings and costs associated with the implemented solar PV systems. Implementation costs and savings will vary based on individual farm's current energy use.

Solar Measure Environment	Annual Electricity Savings (kWh)	Annual Estimated Cost Savings ($)	Overall Energy Savings (MMBtu)	Installed Cost ($)	Estimated Payback Period (Yrs)	Cost Savings ($) Including Energy Efficiency Measures	Aggregate Payback Period* (Yrs)
Poultry Farm	69,300	$7,909	233	$137,400	17.4	$ 8,211	17.1
Meat Production Farm	22,455	$2,919	77	$59,180	20.3	$4,936	14.4
Goat Cheese Production Farm	30,866	$3,087	105	$75,900	24.6	$4,736	17.3
Horse Farm	99,348	$14,127	339	$198,744	14.1	$14,808	13.5
Grain Production Farm	30,866	$2,994	105	$93,033	31.1	$4,532	20.2
Totals	**251,717**	**$31,036**	**859**	**$564,257**	**18.2**	**$37,223**	**15.7**

* The aggregate payback period includes the cost of the energy efficiency measures plus the cost of the solar measures.