Energy Efficiency in Agriculture: A Review of the Role of the Federal Government and State and Private Entities

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Abstract

Agriculture is one of the most important sectors in the U.S. economy. Energy inputs are found in every stage of production, from making and applying chemicals to fueling tractors that lay seeds and harvest crops to electricity for animal housing facilities. This significant energy consumption has left farmers vulnerable to high energy costs and volatile energy market fluctuations that impact fertilizer costs as well. If implemented effectively, energy efficiency measures can help agricultural producers save energy without harming productivity. Effective policies, including educational training and incentives for energy efficiency improvements, can help farmers to enhance their operations. This paper will look at how federal, state, and private programs have encouraged efficiency in the agricultural sector.

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Introduction

Agriculture is one of the most important sectors in the U.S. economy. Abundant natural resources have enabled the United States to consistently supply itself and export large amounts of agricultural products. Since the Green Revolution in the 1950s-60s, great advancements have been made to increase the yield of agricultural production, allowing greater amounts of food, feed, and fiber to be produced from each acre of land. However, the Green Revolution depended on abundant energy available to power agricultural systems. Energy inputs are found in every stage of production, from making and applying chemicals to fueling tractors that lay seeds and harvest crops to electricity for animal housing facilities. This significant energy consumption has left farmers vulnerable to high energy costs and volatile energy market fluctuations that impact fertilizer costs as well.[1] If implemented effectively, energy efficiency measures can help agricultural producers save energy without harming productivity. Effective policies, including educational training and incentives for energy efficiency improvements, can help farmers to enhance their operations. This paper will look at how federal, state, and private programs have encouraged efficiency in the agricultural sector.

Just as efficiency is an important energy resource for powering buildings, homes, appliances, and vehicles, it can help meet the energy needs of farms. Direct energy inputs for agriculture account for about one percent of our national energy consumption.[2] Although this is relatively low compared to other economic sectors, it is costly for farmers across the country. Further, farmers are vulnerable to unstable energy prices and electricity disruptions due to weather and other events.

Concerns about climate change also have increased interest in agricultural efficiency. Agriculture is a disproportionately high contributor to climate change, adding 7% of greenhouse gas emissions (GHG) emissions,[3] as compared to its share of the U.S. GDP, which was only 1% value added from 2002-2006.[4] This is mainly due to high levels of methane gas emissions from livestock and GHG emissions from equipment end-uses for transportation and electricity.[5] Even though energy efficiency measures do not reduce most of the methane that is emitted, which is from animals and waste products, efficiency measures can reduce GHG emissions from electricity and direct fuel use. Concerns about emissions led the U.S. dairy industry, in conjunction with the Department of Agriculture to make a commitment to reducing its GHG emissions by 25% by 2020 as compared to 2009 levels by investing in innovative practices and technologies.[6] This has led to the proliferation of efficiency improvements throughout that sector.

The pattern of agricultural production across the United States varies by climate and geography, as does the nature and intensity of energy use in the sector. For example, farmers growing crops in arid parts of

California may use as much as 30% of their energy expenditures for pumping water and could save $180 million in energy costs by implementing efficient irrigation practices.[7] Indeed, 90% of all electricity used on farms is used for pumping groundwater. .[8] Meanwhile, dairies, in Wisconsin, which use energy for cooling milk and keeping cows warm can save $24.7 million by making these and other practices more efficient.[9] Different parts of the agricultural industry require distinct approaches to energy management. Compared to other states, both Wisconsin and California have relatively strong examples of agricultural efficiency programs, but these programs focus on different agricultural commodities, dairy and field crops, respectively. The geographic and climate variations require great flexibility in any programs on the federal level.

There are many barriers to promoting energy efficiency in agriculture. Barriers include variations in geography, climate and industry structure, as well as a lack of information and access to the capital needed to implement efficiency upgrades. Federal programs that attempt to address these barriers have been important in driving the market towards efficient equipment and practices. The largest is the Rural Energy for America Program (REAP), which has also made the most impact on the landscape of efficient agricultural production. REAP has helped hundreds of farmers recognize the importance and benefits of becoming more efficient. Other agricultural programs, such as the Environmental Quality Incentive Program (EQIP), have also bolstered efficiency by funding innovative approaches including Agricultural Energy Management Plans, which strive to break down barriers to agricultural energy conservation.

Through a combination of federal, state, local, and private sector investments, efficiency improvements can be realized on farms across the country, reducing energy use and improving the overall function of one of America's most important sectors. Overviews of several agricultural energy efficiency policies and programs follow.

Addressing Energy Efficiency and Conservation in the Farm Bill

Background on the Farm Bill

In 1933, the first version of the farm bill was enacted as an attempt to reverse severe drops in food prices during the Great Depression. For example, the price of corn was even listed at negative three cents per bushel in South Dakota in the early 1930s.[10] The 1933 Agricultural Adjustment Act paid farmers not to grow seven basic crops in order to balance supply and demand and thereby stabilize prices.[11] This first act was an attempt to better the lives of famers and those living in rural communities. A few years later in 1935, Congress passed the Soil Conservation and Domestic Allotment Act, which authorized research and preventative measures to curb widespread and severe soil erosion that was inhibiting food production and causing other issues around the country.[12] Subsequent pieces of legislation, which would eventually be

merged with the farm bill, started to address various other environmental issues affecting farming and rural development.

More recent versions of the farm bill have grown to address broader concerns. . It is now an omnibus bill that covers agricultural operations, food processing, nutrition, rural development, and more. Since the 1970s, considered the beginning of the modern farm bill, seven omnibus bills have been reauthorized about every five years. The most recent version, "The Food, Conservation, and Energy Act of 2008," was authorized $283 billion over its five-year lifetime.[13] Lawmakers also authorized funding for some additional related programs subject to yearly appropriations. Actual funding for these programs is often less than authorized levels.

Energy in the Farm Bill

The main focus of energy-related provisions in the farm bill since the 1970s has been biofuel production. However, as energy prices rose and became less stable, lawmakers realized efficiency needed a place as well. The 2002 farm bill, the "Farm Security and Rural Investment Act," was the first to include an energy title. Senators Tom Harkin (D-IA) and Dick Lugar (R-IN) led efforts to include on-farm energy use as well as bioenergy in the bill to help achieve goals of enhancing energy security, boosting rural economic development, diversifying the agricultural portfolio, reducing reliance on export markets, increasing environmental sustainability and addressing climate change.[14] Energy programs were filed under Title IX and authorized at $405 million over five years. Section 9006 of Title IX, The Renewable Energy Systems and Energy Efficiency (RE/EE) Improvements Program, was the first program to include direct financial assistance for energy efficiency and was authorized for $23 million per year.[15]

The 2008 farm bill reauthorized Title IX and also was the first farm bill with the word "Energy" in the bill's formal name, "The Food, Conservation, and Energy Act of 2008." As with the 2002 energy title, the 2008 bill emphasized biofuel production over other energy programs, but there was still a focus on efficiency. In this version of the energy title, the EE/RE Improvements Program was rebranded as Rural Energy for America Program (REAP) and appears as section 9007.

Rural Energy for America Program (REAP)

REAP is the only program in the energy title that directly helps agricultural producers and small rural business owners make energy efficiency improvements and implement clean energy It brought needed attention to the issue of high energy costs that America's farmers and rural communities incur and to the ability of energy efficiency to help them reduce those costs.

Funding for REAP is divided into programs for energy efficiency and renewable energy system improvements, energy audits, and feasibility studies:

- The first and largest portion of funding goes to the **Renewable Energy System and Energy Efficiency Improvement Guaranteed Loan and Grant Program**. In order to qualify for the program an entity must meet certain eligibilities: applicants must be agricultural producers or rural small businesses, in accordance with the Small Business Administration's Small Business Size Standards. Any project that saves energy – electricity, propane, natural gas, or oil – is eligible to be considered for competitive grants or loan guarantees. Grants cannot be used for a new facility unless it is replacing an older facility. REAP financing does not cover agricultural tillage equipment or vehicles. Loan guarantees can range from a minimum of $5,000 to a maximum of $25 million. The minimum Energy Efficiency Improvement Grant request is $1,500 and can cover up to 25% of eligible project costs or $250,000, whichever is less.[16] Applicants applying for grants or loan guarantees for efficiency improvement that cost more than $50,000 must have had an energy audit in order to receive funding.[17] Projects that cost less than $50,000 require a simpler energy assessment, but if a farm energy audit report is included in the application, five bonus points added (out of a total of 130 possible points) to the proposal's evaluation.

- The second portion of funding goes toward the **Energy Audit and Renewable Energy Development Assistance Grant Program**. At least four percent of all funding for REAP is available to conduct energy audits. It is used mainly to meet the REAP acceptable audit requirement for large efficiency projects.[18]These grants are provided to state, tribal, or local governments; higher education institutions; rural electric cooperatives; or public power utilities in order to fund the audits. Farms and rural businesses receiving the audits are required to pay at least 25% of audit costs. [19]

- The last portion is the **Feasibility Studies Grant Program**, which assists those applicants that are required to complete feasibility studies by the U.S Department of Agriculture (USDA) or other government agencies' energy programs in order to receive funding. The grants can cover up to 25% of the studies' costs and are limited to a maximum of $500,000.[20] These studies are normally for renewable energy systems.

REAP is funded through a combination of "mandatory" funding and annual appropriations. The levels have varied over the years. The FY2012 budget funded REAP at about $70 million, which is equivalent to the FY2011 funding level[21]

As Congress gets closer to re-authorizing the farm bill, budgetary constraints make it uncertain what will happen with each of the provisions within the energy title, including REAP. All thirteen energy provisions in Title IX are only authorized for the duration of the current 2008 to 2012 farm bill.

Energy Efficiency in REAP

REAP has promoted agricultural efficiency goals across the country. Energy audits are one of the most important ways efficiency can be promoted, as they allow farmers to assess how much energy their operations consume and identify target areas for improvement. The grants and loan guarantees have helped agricultural producers and small businesses realize the benefits of energy-efficient equipment.

By increasing the number of energy audits and technology upgrades on farms and at rural small businesses, REAP has helped reduce long-standing barriers to efficiency and modernization. Using REAP grants, many states that previously did not have farm energy audit programs or had inactive programs have been able to perform audits for many more agricultural producers across the country.[22] The audit grant program greatly increased the ability of farmers to apply successfully for funding for efficiency upgrades.

Results

REAP has been considered a success by the agricultural sector and in rural communities. The program is well liked among farmers. This popularity is evidenced by the steadily increasing demand for REAP funds over recent years—appropriated funds are unable to keep up with the number of grant and loan requests each year. In 2009, there were over $140 million in grant and loan guarantee requests but only $60 million in appropriations.[23]

During FY2009 to FY 2011 USDA Rural Development awarded 5,733 REAP projects resulting in $191,935,584 in grants and $164,530,349 in loans leading to savings or generation of 6.5 million MWh.[24] With 4,070 grants and loan guarantees, energy efficiency improvements constitute 71% of these awards but a lower percentage of the funding, totaling $97,393,055 in grants and $41,850,622 in loans.[25] . USDA has repeatedly found that REAP has created a major incentive for farmers to pursue energy efficiency projects. For example, in Camden Township, Ohio, Norman Baxter of Green Circles Growers received a REAP grant for $227,500 to install an energy efficient curtain on his greenhouses. When asked whether or not he would have installed the curtain without REAP funding, he stated, “It’s questionable. The grant made it a definite ‘go’ for us.” It is clear that REAP has helped to reduce barriers for energy efficiency projects.[26]

Certain technologies, sectors, and states have benefitted more than others from the REAP grants. For instance, there are numerous grants for grain drying, which is one of the most energy-intensive processes in agriculture.[27] States such as Iowa, where grain is the major agricultural product, have encouraged REAP applications by providing free audits.[28] In general, those states that provide more, and cheaper, energy audits have been able to increase the number of grants they receive.

Although most reviews of REAP are positive, there are some negative ones as well. Not only is the application process long and complicated, but access to energy audits is also not always readily available. Even when audits are accessible the cost can be more than producers can afford. These barriers to REAP have made it difficult for some farmers to receive the assistance they need; the addition of the audit grant program has made it easier for consumers to apply for project grants.[29]

Examples of REAP Energy Efficiency Awards

In Indiana, a wheat farmer received a $43,000 grant to replace his old, inefficient grain dryer and make other energy efficiency improvements. This farm owner expects that the reduction in energy expenditure will save him about 10 cents per bushel.[i] Another wheat farmer in North Dakota who received a grant and loan guarantee to purchase a new efficient grain dryer saw that not only did he save money, but he also had a 35% larger drying capacity.[i]

In Georgia, one farm received a REAP grant to replace a 20-year-old diesel motor for its irrigation system with an electric one. The replacement generated 90% savings and helped save one job.[i]

A REAP grant was awarded to the owners of a 150,000 square foot commercial greenhouse complex in New Hampshire to assist in the purchase and installation of $161,271 worth of energy curtains for grow houses. The project will save just over $30,000 and more than 2.2 million BTUs annually.[i] Without the REAP grant, this would have resulted in about a five year payback period.

Other Federal Programs

There are other programs administered by USDA that encourage or enable financing for energy efficiency in agriculture. For the most part, these programs do not focus on energy efficiency or even energy specifically, but indirectly encourage efficiency through various finance tools and/or outreach and education. These exemplify other approaches to administering energy conservation and efficiency on the farm that state, localities, or private programs can use.

The programs address agricultural conservation broadly, but all contain aspects pertaining to energy. States may find this approach easier to implement; instead of creating a new agricultural efficiency program, they can promote energy conservation under existing programs.

Sustainable Agriculture Research and Education Program (SARE)

(SARE), administered by the National Institute of Food and Agriculture, provides grants and educational materials on a broad range of sustainable agriculture topics. While it does not focus on energy efficiency, SARE provides outreach to farmers on how to conserve energy.[30] As discussed below, similar outreach can be done by a state energy office or utility demand-side management programs.

Conservation Stewardship Program (CSP)

CSP, which is a part of the farm bill conservation title and administered by USDA's Natural Resources Conservation Service (NRCS), provides technical and financial assistance to agricultural producers to promote resources conservation and enhancement of working farmland. Nearly all types of land nationwide are covered "on which resource concerns related to agricultural production could be addressed."[31] The program encourages conservation through the installation and adoption of measures and practices that achieve environmental stewardship goals for applicants' respective regions. States use eight resource issues pinpointed by CSP to identify resource concerns that are priorities for that region and award grants based on farms' previous activities and future plans to alleviate those concerns. The Conservation Measurement Tool (CMT) estimates the level of environmental benefit to be achieved by a producer by implementing these conservation activities and is used to evaluate the program.

Energy is one of the eight resource issues considered by the CSP, as is water quantity, which can include the efficient use of water for irrigation, which, in turn, usually reduces the amount of energy used for pumping water. This is one of the ways that energy conservation is addressed in the program. The inclusion of energy questions in the CMT allows farmers to examine their practices, identify improvement opportunities, and enhance their chances of being accepted by the CSP. Energy conservation is also promoted by encouraging a comprehensive approach to stewardship in which

participating farms receive more award money by adopting additional conservation enhancements, such as reductions in tillage and irrigation, which also save energy.

The program differs from REAP in its approach to incentivizing energy efficiency. A low percentage of farms participating in CSP have made efficiency improvements. Only 228 out of 20,567 farms received money by reducing fuel use for field operations.[32] The largest category of energy efficiency measures funded by CSP relate to irrigation efficiency, though that is still a relatively low number. While few farms have used CSP for energy efficiency enhancement, the 2008 Farm Bill expanded and improved the program by spreading the program nationwide in the hope that more farms would participate.[33] This program could serve as a model for states to integrate energy efficiency into conservation programs that already exist and to incentivize energy efficiency as part of broader sustainability measures that benefit agricultural producers.

Environmental Quality Incentives Program (EQIP)

EQIP, also administered by the NRCS, is an important component of the farm bill's Conservation title. It provides funding for agricultural producers to implement conservation practices for energy, soil, and water.[34] Unlike CSP, farmers are not required to address conservation practices before applying for funding. Like CSP, most grants under EQIP are grouped to address certain regions and issues. But EQIP also provides funding for national programs, not just individual farms, to accomplish its goals.[35] Two programs relevant and important to stimulating energy efficiency are listed below.

On-Farm Energy Initiative

This initiative provides funding for farmers to contract a service provider to develop an Agricultural Energy Management Plan (AgEMP), [36] also known as an on-farm energy audit. The program will also provide financial assistance for implementing the recommendations resulting from the AgEMP. AgEMPs are important because they have two components, a landscape component for efficient field practices that result in tractor fuel savings, excluding vehicles and tillage equipment, and a headquarters component for efficient power usage in buildings for livestock, grain storage, etc.

Conservation Innovation Grants (CIG)

CIG is a competitive voluntary grant program in which grants are awarded for up to 50% of project costs.[37] Projects are intended to stimulate the development and adoption of conservation technologies and innovative approaches for agricultural production. The 2011 grants were directed towards certain watershed lands and also towards practices and technologies that help mitigate GHG emissions. One of the 2012 opportunities focused on nutrient management, energy conservation, soil health, wildlife, and CIG projects assessment.

Energy efficiency measures and technologies have been granted awards since the program's inception in the 2002 farm bill. One was awarded to the company EnSave and the Dairy Research Institute to provide data collector training in ten states and 40 free energy management plans to farmers.[38] The data collectors use EnSave's FEAT software tool, an innovative instrument that now has a better chance of being scaled to market due to these grants. This technology facilitates more accurate data collection within an AgEMP, which will inform farmers of the amount of energy consumed. Data collection serves as a form of auditing and allows farmers to better allocate resources in order to conserve energy as well as receive more detailed advice from EnSave's engineers regarding energy-saving practices.[39]

State, Local, and Private Programs and Organizations

How states encourage and expand energy efficiency in all sectors – homes, commercial buildings, and transportation - varies from state to state, and agriculture is not an exception. Certain states require their electric and natural gas utilities to run demand-side management (DSM) programs in order to meet energy savings goals. . Some states have state-administered energy efficiency programs in addition to or instead of utility efforts. Funding levels also vary widely.

States have different contexts and priorities among their agricultural energy efficiency programs. In 2009, the National Center for Appropriate Technology found that there were 27 states[40] with farm audit programs, though that does not mean that all of these are readily accessible or have been able to provide financial assistance for the implementation of post-audit upgrades.[41] Although many of these programs are under–staffed, underfunded, and reliant on federal grants, they have increased the number of people with expertise in performing agricultural energy assessments. REAP has been an important factor in encouraging states to increase access to energy audits. The state programs listed above all conduct audits that are REAP compliant.

Numerous states, utilities, and rural electric cooperatives also have implemented agricultural energy programs that offer financial incentives. State and utility programs have the benefit of working on a more local level, closer to potential participants. Farmers have found that programs run by utilities or state entities are sometimes easier to access than REAP funding.[42]

Some agricultural sectors have been especially interested in energy efficiency programs. As mentioned previously, the dairy industry has stated that it will reduce its GHG emissions by 25% by 2020, as compared to 2009 levels. This has resulted in a proliferation of strong dairy programs, although many of them focus on promoting anaerobic digesters rather than energy use efficiency. When the industry made the GHG emissions reduction announcement, the Innovation Center for U.S. Dairy, which represents 70%

of the dairy supply chain, identified twelve programs that would help the sector reach this goal and create about $238 million in business across the country.[43] These program areas include farm energy audit programs and the Dairy Processing Carbon through Energy Efficiency (D-CREE) program for milk processing plants. The research and deployment done by these programs has led to innovation in the sector, such as evaluating the commercialization of efficient, ultraviolet non-thermal processing for pasteurization,[44] as well as expanding use of variable speed drive (VSD) pumps for milk, to improve energy efficiency and productivity.

The next section discusses a variety of organizations and programs supporting agricultural energy efficiency. They have all been relatively successful and provide a basis for future programs and initiatives.

Rural Electric Cooperatives (RECs)

In the 1930s, President Roosevelt paved the way for rural electric systems,[45] which later became known rural electric cooperatives. These cooperatives are private, not-for-profit entities that are governed by their consumers and are operated at cost. Electric cooperatives are important for promoting energy efficiency in rural areas, including the agricultural sector. Cooperatives are responsible for selling 12% of all electricity in the country.[46] The vast majority, 96% of rural electric cooperatives, implement energy efficiency programs for their consumers.[47] However, most RECs do not execute purely agricultural energy efficiency programs but include farms under a larger efficiency effort.

Many RECs also provide consumer education but no financial incentives for energy efficiency due to insufficient funding. Other cooperatives have come up with creative mechanisms for providing incentives due to the lack of expendable money. Some RECs have been using a financial mechanism known as on-bill financing, which provides financial assistance for upgrades to members and is paid back on their monthly utility bills.[48] There are not well-documented examples of this mechanism being used for agricultural production, but it may present a significant opportunity for producers to engage with cooperatives to make operations more efficient.

To help alleviate these problems, electric cooperatives are allowed to apply for REAP grants. Several have done so in order to add renewables to their grid and provide support for efficiency programs, such as free or low-cost audits or financial assistance for upgrades. While some of these grants go towards helping agricultural producers reduce energy consumption, grants to cooperatives can be used to provide incentives for all customers of the cooperative.

Private Companies and Organizations

EnSave

EnSave is a unique company that specializes in designing and implementing *agricultural* energy efficiency programs in the United States. Examples of EnSave's work over two decades can be seen across the country, from California to Virginia. EnSave has over 20 years of energy conservation expertise in the agricultural sector and is the nationwide leader in energy audits and energy management plans.[49] In addition to program creation, EnSave trains workers to implement energy efficient techniques, and it provides farm energy audits in 49 states as a designated NRCS as a Technical Service Provider for Headquarters Agricultural Energy Management Plans. It has delivered several thousand farm energy audits and agricultural energy management plans.

Private firms, such as EnSave, can play roles in developing state agricultural energy efficiency programs. For example, EnSave helped create the Maryland Statewide Farm Energy Program, a collaborative cost-sharing program funded by the Maryland Energy Administration.[50] This program provides energy audits for agricultural producers in Maryland, and technical assistance and incentives to all producers that install qualifying equipment. Producers do not need to have an energy audit to apply for these incentives. From 2007-2010, the program has saved 52,700 million Btu of natural gas, 27,189 gallons of propane, and 1,789 MWh. Annually it has saved about $578,726 in energy consumption costs for Maryland farmers.[51]

Efficiency Vermont

Efficiency Vermont, a state contracted energy efficiency utility works with government, policy makers, communities, and utilities to help Vermonters become energy efficient.[52] Efficiency Vermont is operated by the private, nonprofit organization, Vermont Energy Investment Corporation (VEIC), which consults for governments and utilities on efficiency and renewable program implementation. VEIC deals mostly with green buildings and not with agriculture but covers all areas within its programs. Efficiency Vermont is an example of an organization/program that does not serve agricultural producers exclusively but works to enhance energy efficiency across all sectors of the economy. This has proven to be helpful in that some incentives that can be used on the farm are not limited only to farmers but can also be applied in commercial buildings, residences, etc. A broader customer base means greater interest from contractors, vendors, auditors, and other involved parties. Efficiency Vermont works to connect consumers with specific vendors that best suit their needs. This enables a seamless process for retrofits and purchasing of the goods needed for construction. It also bolsters the local economy by directing consumers to local vendors that hire local employees.

Specific Programs

PG&E's Advanced Pumping Efficiency Program (APEP)

Pacific Gas and Electric's Advanced Pumping Efficiency Program is a good example of a utility program for agricultural producers. It is funded along with other demand-side electricity management programs by a surcharge on customer bills called a systems or public benefit charge. This program was developed and is managed by the Center for Irrigation Technology (CIT) at the California State University, Fresno.

Previously called the Agricultural Pumping Efficiency Program, it is an "educational and incentive rebate program developed to improve overall pumping plant efficiency and to encourage energy conservation."[53] APEP expanded its scope beyond agriculture after realizing the opportunity for energy efficiency improvements in other sectors that use pumping, but it still serves as an important resource for agricultural producers looking to make their irrigation systems more efficient. It offers four main services: education, technical assistance, subsidies for pump efficiency tests, and incentives for pumping system retrofits. This program is significant, because it addresses a geographic resource concern, which is insufficient water in California, and an energy concern, which is the energy use for pumping water. It provides cash incentives for at least 300 retrofit projects per year as well as 14 educational seminars annually.[54] A pilot diesel pumping efficiency project conducted in California retrofitted a pump and achieved an increased efficiency of 14.3% to 24.4% and saved $7,787 in its first year of use. A natural gas pump retrofit project in Rancho, California increased water flow by 1,389 gallons per minute (gpm) and garnered first-year savings of about $60,000.[55]

Missouri Agricultural Energy Savings Team – A Revolutionary Opportunity (MAESTRO)

MAESTRO is another program developed by EnSave, but it is a good example of how statewide programs can be developed to provide energy efficiency incentives. Currently the program is funded by a $5 million competitive grant from the Department of Energy,[56] but the hope is that the program will continue when this funding runs out. The program is different from others in that it asks farmers for a $125 commitment for their farm energy audit but will return the money after the farmer implements the audit's recommendations and saves at least 15% of the pre-upgrade energy use due to energy-saving practices. The program also offers grants of up to 75% of the project's cost, with a maximum of $12,000.[57] This "down payment" tries to address the problem of farmers getting energy audits but not following through on implementing energy savings mechanisms. The initial commitment fee also ensures that farmers are serious about entering the program. If they are not, MAESTRO will not have wasted its money.

New York State Energy Research and Development Authority (NYSERDA)

Although agriculture makes up a small percentage of New York State's GDP, the industry has a significant presence in the state. Dairy is New York's largest agricultural sector,[58] but there also are a considerable number of apple orchards, vineyards, and other types of agricultural operations. NYSERDA has a noteworthy history of providing New York farmers with financial assistance for efficiency upgrades by using the state's system benefit charge. The Agricultural Energy Efficiency Program (AEEP), which has proven to be hugely popular, expended its last funding allotment in about 90 days. Under this program, NYSERDA offered energy audits as well as incentives covering up to 75% of the cost of electric[59] and natural gas efficiency measures, which is much larger than many programs. NYSERDA is widely known throughout the state and has high visibility when offering programs.

Another NYSERDA initiative, the Agricultural Disaster Energy Efficiency Program, is unique in that it tries to address a gap in general conservation measures for agricultural producers and improve farms' efficiency as a part of disaster relief. Other aid for farms after natural disasters focuses on crops and soil conservation. Under this program, $4,175,000 was available to agricultural producers harmed by either Hurricane Irene or Tropical Storm Lee to help replace electric and natural gas equipment or distribution systems with efficient equipment.[60] To receive assistance, which can fund up to 100% of the costs up to $100,000, documentation had to be provided for pre-qualified efficiency measures.[61]

Conclusion

The popularity of REAP and the increasing number of state and private energy efficiency programs demonstrate the growing interest in energy improvements on farms. REAP has become a widely known program and has made farmers more aware of the benefits of energy efficiency. Agricultural producers had long been left out of the energy efficiency equation in some areas, even as they are increasingly subject to high and volatile energy costs. Fortunately, this is changing because of programs like REAP and the state and utility programs described above. However there is still opportunity to grow.

Efficiency measures not only save energy but also can make farmers more productive and conserve our natural resources. For example, the efficient use of water through advanced pumping systems and drip irrigation on dry lands is beneficial to the sustainability of the land and also saves a large amount of energy. The agricultural sector has increased its focus on energy efficiency in recent years and continues to fund programs and services promoting rural efficiency.[62] Many, though not nearly all, large industrial farms have the financial ability to make these investments, and some are realizing the benefits. Meanwhile, smaller farmers with little or no spare capital may not be able to make the improvements efficient equipment can offer.

REAP's success in promoting efficiency is a result of many factors, including good marketing and familiarity of NRCS and the state agriculture departments that administer it. Over the years, REAP has also gone through a number of modifications to overcome barriers applicants originally faced. It has stimulated installation of efficient equipment on farms. A growing number of farmers recognize the benefits of upgrading equipment.

The exclusion of agricultural tillage equipment and vehicles represents a significant gap in REAP, but such equipment may be better addressed in other programs. While buying more efficient vehicles and machinery that can reduce oil consumption, the biggest changes can be made through reducing overall tillage and reducing fertilizer applications. These behavioral changes are difficult to implement under a grant and loan program, such as REAP, that mostly provides funds to cover equipment expenses. They may be better addressed as part of land conservation and sustainable farming programs, such as the EQIP On-Farm Energy Initiative and its management plans. However, the energy components of these programs are underutilized. Greater outreach could help farmers take advantage of energy assistance for which they are already eligible.

The range of state and organizational programs is beneficial because of the ability to target farms regionally and by sector. These programs can also be funded through different means and have more flexibility to target program designs. Outreach and advocacy among farmers is key to implementing these programs. States, utilities and other organizations have viral roles to enhance agricultural energy efficiency. They can be closer to program users and stakeholders, so they can be more responsive to state, regional and local needs and contexts. Expanding these programs has the potential not only to save energy but also to benefit the agricultural community and the broader rural economy.

While existing programs have made strides towards making farm operations more efficient, there is much room to expand the scale and scope of such programs. States with agricultural efficiency programs are generally those with aggressive and broad energy efficiency policies and programs. However, many states with strong agricultural bases do not have such widespread efficiency programs.
States can tailor programs to their needs, contexts, and available resources. For example, if a state or region does not have the funding to implement an overarching state-wide plan, then it can start in one smaller area and expand depending on the program's success. This is a model used, for example, in the development of the Maryland Statewide Farm Energy Program in which audits were first offered in a portion of the state and then expanded to other regions before being made available statewide.

Another important way for the agricultural sector to become more efficient is if individual sub-sectors make commitments and initiatives to reduce energy use. An example is the dairy industry's greenhouse

gas commitment. Although many GHG emissions from dairy are not a result of energy use, being more efficient serves GHG reduction goals. The dairy industry GHG commitment spurred many successful projects targeted specifically at dairy energy use. A similar industry push could enable other agricultural sectors to make the changes needed to be more energy efficient.

Implementing energy efficiency on farms only addresses a part of agriculture's energy impacts. Agricultural and, generally, food industry, energy use and greenhouse gas emissions are also the result of other factors, such as waste management, food distribution, and fertilizer production and use. Encouraging producers to become more efficient is good for farmers' bottom lines and is a step in the right direction. Federal and state programs are already helping move the market towards a more efficient use of energy, and many farmers are reaping the benefits.

About the Alliance to Save Energy

The Alliance to Save Energy is celebrating its 35th year as a nonprofit organization that promotes energy efficiency worldwide through research, education and advocacy. The Alliance advances energy efficiency policies, conducts research on various energy-related topics, and increases awareness and knowledge about the many ways that energy consumption can be reduced in the United States and throughout the world. For more information about the Alliance and its activities, please visit www.ase.org, follow us on Twitter and like us on Facebook.

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