



Conservation Evaluation and Monitoring Activity

Agricultural Energy Assessment

CEMA 228

Definition

A Conservation Evaluation and Monitoring Activity (CEMA) is the assessment, monitoring, or recordkeeping activities required to plan, implement, or determine the effectiveness of conservation practices as described herein.

An assessment of the energy consuming activities and components of an agricultural operation.

Applicable Land Uses

All NRCS recognized land uses.

REQUIREMENTS

Qualified Individual Requirements

The Natural Resources Conservation Service (NRCS) strongly encourages CEMA participants to know the Qualified Individual (QI) requirements to ensure the person they employ to provide the CEMA is a good match for their needs and objectives.

A QI for this CEMA is an energy auditor defined as someone who has at least one of these qualifications:

- Professional Engineer's license
- Association of Energy Engineers (AEE) — Certified Energy Manager (CEM)
- Association of Energy Engineers (AEE) — Certified Energy Auditor (CEA)
- State certified/licensed farm energy auditor (if applicable)

Documentation Requirements:

The QI will provide documentation that demonstrates their possession of at least one of the credentials described above.

General Requirements

The CEMA includes the performance of work and documentation of the tasks, results, interpretations, and other activities described herein.

Qualified Individuals, as specified in the preceding section, completes tasks as described in the DELIVERABLES section.

Prior to initiation of the CEMA, the client will schedule a conference with the QI as stipulated in this section and NRCS field office staff to ensure an understanding of the client objectives, required deliverables, and characteristics of the CEMA tasks. The meeting between all parties may take place in person or electronically.

A QI may use any of the reference information, conservation practice standards and related documents served in the NRCS Field Office Technical Guide (FOTG) for the state where this CEMA is performed. The FOTG home page hyperlink is: <https://efotg.sc.egov.usda.gov/#/>

Technical Requirements

An Agricultural Energy Assessment is a baseline assessment of all the energy use of systems, equipment, and facilities for the entire agricultural operation. The assessment documents a typical year of the energy use required to operate the agricultural operation, and the strategies by which the client can prioritize on-farm opportunities to increase energy efficiency and reduce energy use. The client must be involved with inventory and evaluation of the current agricultural operation and the energy management planning process by identifying their goals and objectives.

The assessment will meet “Type 2 Audit” minimum criteria established in the latest version of **ANSI/ASABE S612 Performing On-farm Energy Audits** standard.

An on-site visit is required to meet with the client to inventory, evaluate, and obtain information about the current agricultural operation energy use, management goals and objectives. Enterprises to be evaluated will include all relevant farm enterprises and other enterprises requested by the client.

State specific requirements for NRCS contracting limits must be checked for applicability, such as developing an assessment with a client having multiple agricultural operations that run independently but are under the same ownership.

1) Summary

Present the findings of the assessment in a “Summary” section using tables 1 and 2 with the headings shown as a guide.

- a) Include a separate line for each recommended measure/component within each major activity of the farm enterprise(s) evaluated.
- b) If energy efficiency improvements for one recommendation require the implementation of a second recommendation, indicate in the table, and adjust the entries appropriately.
- c) Organize the recommendations by major activity as listed in ASABE S612 table 1.

Table 1. Summary of Energy Efficiency Improvements

Recommended Measure	Estimated Annual Reduction in Energy Use					Estimated Costs, Savings, Payback, and Prioritization for Implementation			
	Electric Savings (kWh)	Natural Gas Savings (ccf) ³	Propane Savings (gal)	Other ¹	Energy Savings (MMBTU)	Installed Cost [a], \$ ³	Energy Cost Savings [b], \$/yr.	Payback in Years [a / b], yr.	Est. Life in Years ²
Totals									

1. Use the *Other* column to aggregate any miscellaneous sources of energy.
2. Estimated Life is expected useful life of the equipment recommended with standard O&M activities.
3. Unit of purchase.

- d) Determine the estimated annual reduction of emissions for each recommended measure.
- i) NRCS has developed a Quick Energy calculator that can be used. The tool estimates air emission effects due to energy savings for fuels and electricity into atmospheric emission reductions. The tool relies on the US Energy Information Administration state-level aggregated emission factors for electricity, liquid and gaseous fuels to generate estimates of emission savings. The Weblink to the tool, NRCS COMET Quick Energy Calculator, is located at <http://cometfarm.nrel.colostate.edu/QuickEnergy>. If other methods are used, provide supporting documentation and references.
 - ii) Present the results using table 2 as a guide.

**Table 2. Estimated Annual Reduction of Emissions
(Environmental benefits for each recommended measure)**

Recommended Measure	Energy Savings (MMBtu)	Environmental Benefits ¹				
		Greenhouse Gases ²			Air Pollutant Co-Benefits ²	
		Estimated CO2 (lbs.)	Estimated N2O (lbs.)	Estimated CH4 (lbs.)	Estimated SO2 (lbs.)	Estimated NOx (lbs.)
Totals						

1. Environmental Benefits values may be calculated from <http://cometfarm.nrel.colostate.edu/QuickEnergy>.
2. CO2 is a green-house gas; SO₂ and NO_x are ambient air contaminants.

2) Background and Site Information

Provide a narrative that includes:

- a) Date that the site visit(s) was completed.
- b) Descriptions and locations of facilities, primary equipment, and other structures.
- c) Type, size, and overall management scheme of the operation. Describe the farm enterprise(s), (e.g., poultry, dairy, field crop, etc.) along with production levels, and any unusual factors that affect energy use such as renewable energy systems. Narrative includes enough detail that all energy consuming systems/components are technically identifiable as to the processes employed to meet the agricultural operation production needs.
- d) Client concerns and objectives for the agricultural operation. Describe why the client wants an on-farm energy audit and their specific objectives.
- e) Aerial map or equivalent plan view that shows the agricultural operation including all structures, such as animal housing, shops, grain storage, and processing facilities, and locations of the headquarters, fields, and irrigation system components. Identify, on the map, where recommended measures are located.

3) Current Equipment and Baseline Energy Use

Develop baseline energy consumption information:

- a) Determine annual energy consumption of all major activities and applicable components of each enterprise as listed in ASABE S612, table 1.
- b) Provide detailed analysis for agricultural enterprises that, taken together, account for at least 85% the total baseline energy use of the agricultural operation. Additional enterprises may be analyzed if requested by the client.
- c) For field crops, fruits, and vegetable enterprises, evaluate, at a minimum, the applicable major activities and components including motors or pumps, drying, crop/feed storage, water management, material handling and irrigation.
- d) Analysis of cultural practices listed in ASABE 612, table 1 (planting, tilling, harvesting, and engine driven equipment) are optional for field crops, fruits, and vegetable enterprises.
- e) Annual energy usage and cost data for the baseline energy consumption separated by energy resource.
- f) A baseline energy use from a prior, typical, consecutive 12-month (or other) period. Document all major activities associated with all farm enterprises being evaluated.
 - i) Describe the components, primary equipment, and/or details of the major activity (type of use), as appropriate according to the amount of energy used, such as:
 - (1) Type and size of equipment (age, make, and model).
 - (2) Equipment infrastructure, including electrical system phase and voltage, natural gas or propane pipelines and distribution, etc.
 - (3) Component equipment ratings/production levels such as hp, Btu input, Btu output, efficiency, lighting levels (lumens or Ft-c), ventilation levels (CFM), R-value and thickness of insulation, etc. Describe any differences between factory ratings and actual or apparent ratings due to age, operation, and maintenance of equipment or system.

- (4) Auxiliary items to enhance management such as thermostats, timers, and manual overrides of automatic systems.
- ii) Estimate the annual energy consumption, by energy type, for each major activity.
- iii) Estimate the hours of use per year for each component evaluated.
- iv) Describe major activities not applicable to the farm enterprise, or which have no opportunities for improved energy use.

4) Recommended Energy Improvement Measures/Components

The assessment will identify potential energy improvement measures that will reduce energy use or increase energy efficiency and address the energy management concerns of the relevant enterprises. The assessment must provide appropriate estimated energy savings relative to the baseline energy use for each recommendation.

- a) For each recommendation, evaluate and document, in tables 1 and 2, the following:
 - i) Replacement, changes, or additional components (number, type, and location) and infrastructure. Where increase of component output is desired, list the alternatives available for the component replacement. Justify each alternative with a description of benefit and costs.
 - ii) Estimated energy savings of component alternatives, first in the common sale units (kWh, gallons, etc.) and then converted to energy units of millions of British thermal units (MMBtu).
 - iii) Estimated annual energy cost savings of component alternatives, in dollars per year as a departure from the baseline condition.
 - iv) Estimated installation cost in dollars. Utilize estimates for example products from vendor quotes, client input, or local sources. Reference the source of the estimated cost.
 - v) Estimated reductions in emissions for CO₂, N₂O, CH₄, SO₂, and NO_x.
 - vi) The simple payback period in years (component alternative with installation cost divided by estimated annual cost saving, in years).
 - vii) Estimated life, in years, of the component alternatives. The estimated life is the useful life of the component/equipment with standard operation and maintenance activities. Reference the source of the estimated life.
- b) Include energy use and emission reductions for all recommendations in tables 1 and 2. Energy savings and cost data for beneficial energy utilization measures may be included where appropriate for future use by the client.
- c) Include sufficient product information (e.g., product specifications, product output, energy efficiency and cost) for client's planning needs.
- d) Include assumptions made, calculations or methodologies used, and supporting references or information for energy savings or efficiency results.
- e) Include sufficient documentation to allow a third party to understand and evaluate the recommendations.
- f) Use non-discounted prices for reporting the installation cost and payback period. Do not factor in financial incentives such as EQIP payments, RD REAP loans, or state energy rebates in the installation cost.

- g) Recommendations shall consider current output levels compared to client's needs and industry standards and recommendations, including NRCS Conservation Practice Standards. Consider potential increases in products or production and changes to energy efficiencies when making recommendations.
- h) All recommendations shall be closely linked to reducing energy use or improving energy efficiency. Component alternatives primarily related to increased production (without significant energy efficiency improvements) may be included, but not be a part of the recommendations.
- i) Prioritize the recommendations, based on the QI's professional judgement, by those that have the most benefit. Consider recommendations with low energy cost savings, high installation costs, or long payback periods as low priority or not recommended.
- j) Organize the analyses by enterprise and major activity as listed in table 1 of the ASABE S612 standard.

5) Appendix

Include technical documentation of sources used for analysis and evaluations. Include the actual documents, references, and/or links that contain technical information used to estimate energy savings and cost, such as:

- a) Fact sheets.
- b) Existing components and recommended components product information or manufacturer product information sheets.
- c) Comparisons of specific product recommendations.
- d) Journal article citations.
- e) Explanations of privately developed analysis methods, software, and tools.

Definitions

Baseline Energy Consumption—The energy consumption for the previous 12 months, or another recent consecutive 12-month period typical to that agricultural operation. Where weather or other extreme events, such as catastrophic mortality or crop loss, alter the typical energy use in the previous 12 months, an alternate 12-month period may be used for the evaluation with documentation and rationale. Similarly, more than one year's data may be used if appropriate for activities being evaluated such as grain drying. Energy use data is obtained from the client. This documented energy consumption becomes the baseline for comparison of recommended energy efficiency improvements.

Component—Individual parts of a major activity. For example, a lighting activity would include the following components: lamps, timers, and sensors.

Energy—For the purposes of these requirements, energy is the resource used to power equipment to do mechanical work such as movement, transfer, heat, light, ventilation, irrigation, or cooling.

Energy Resource—Source from which energy is obtained, including gasoline, diesel fuel, biofuel, propane, natural gas, electricity, solar, wind, wood, biomass, geothermal, etc.

Farm Enterprise—The production category or categories of a farm. For example, a farm may include a field crop enterprise and a swine enterprise (see ASABE S612 table 1.)

- Dairy
- Swine
- Poultry
- Beef/veal
- Field Crops
- Fruit/Vegetables
- Aquaculture
- Nursery/Greenhouse
- Irrigation

Major Activity—A discrete activity associated with a farm enterprise that utilizes an energy resource or that controls energy resource use. For example, a poultry enterprise may include heating and ventilation; a dairy enterprise may include lighting.

Relevant Enterprise – For purposes of this assessment, relevant enterprises are those that account for 15% or more of the total annual baseline energy usage, either individually or in combinations.

DELIVERABLES

The QI must provide documentation showing all the tasks indicated in the **General Requirements** section, the **Technical Requirements** section, and the following sections:

Cover Page

Cover page reporting the technical services provided by the QI. Cover page(s) must include the following:

- 1) CEMA name and number.
- 2) Participant information: Name, farm bill program name, contract number (QI obtains contract number from client), land identification (e.g., State, county, farm, and tract number).
- 3) QI name, address, phone number, email.
- 4) A statement by the QI explaining how they currently meet the QI Requirements for this CEMA. Attaching or enclosing a copy of documentation for how the QI requirements are met is required. Examples include:
 - Certification Name and Number
 - License Name and Number
- 5) A statement by the QI that services provided meet NRCS requirements, such as:

I certify the work completed and delivered for this CEMA:

- *Complies with all applicable Federal, State, Tribal, and local laws and regulations.*
- *Meets the general requirements, technical requirements and deliverables for this CEMA.*
- *Is consistent with and meets the conservation objectives for which the program contract was entered into by the client.*
- *Addresses the client's conservation objectives for this CEMA.*

QI Signature _____ Date _____

- 6) A Participant's acceptance statement, such as:

I accept the completed CEMA deliverables as thorough and satisfying my objectives.

Participant Signature _____ Date _____

- 7) A space for an NRCS reviewer to certify the agency's acceptance of the completed CEMA and, such as:

NRCS administrative review completion by:

Signature _____ Title _____ Date _____

Notes and Correspondence

- 1) Document each site visit, its participants, the activity completed in the field, and results of each site visit.
- 2) Copies of correspondence between the QI and the client relating to decision-making and completion of this CEMA.
- 3) Copies of observations, data, technology tool output, or test results prepared during completion of this CEMA.

Maps, Diagrams, Plan Views

An aerial map or equivalent plan view is required as described in the **Technical Requirements** section 2) Background and Site Information.

Evaluation or Monitoring Results

A report of the results of the evaluation or monitoring activity. Include all documentation associated with Technical Criteria sections as follows:

- 1) Summary
- 2) Background and Site Information
- 3) Current Equipment and Baseline Energy Use
- 4) Recommended Energy Improvement Measures/Components
- 5) Appendix

Deliver Completed Work

- 1) The QI must prepare and provide the participant two sets of all of the items listed in the **General Requirements**, the **Technical Requirements** and the **Deliverables** sections of this document.
- 2) One set is for the participant to keep.
- 3) The other set is for the local NRCS Office.
- 4) The QI may transmit a set of the completed work to the local NRCS Office, if their participant has authorized it.

It is recommended to provide the NRCS field office an opportunity to review the CEMA deliverables, prior to asking for their acceptance.

References

USDA Natural Resources Conservation Service. Field Office Technical Guide.
<https://efotg.sc.egov.usda.gov/#/>