

**NRCS Practices That Have the Potential to Reduce Use of Fossil Fuel**

<b>Practice</b>	<b>Lead Discipline(s)</b>	<b>Practice Code</b>	<b>Rationale</b>	<b>Primary Resource Concern(s)</b>	<b>Need to add energy considerations to practice</b>
Headquarters Agricultural Energy Management Plan (Agricultural Energy Management Plan)	CED - ESD	122	Practice provides baseline energy consumption information, recommendations for how to improve energy conservation, cost of improvements, and payback periods for each recommendation for equipment at the farm headquarters.	Erosion-wind, sheet and rill, ephemeral gully, irrigation-induced; Soil Condition-organic matter depletion, sediment deposition; Water Quantity-inefficient water use on irrigated land; Water Quantity-inefficient water use on non-irrigated land; Surface Water Quality-pesticides, nutrients, sediment; Air Quality-PM, ozone, GHG.	NO-already done
Landscape Agricultural Energy Management Plan (new)	CED-ESD	124	Practice provides baseline energy consumption information, recommendations for how to improve energy conservation, cost of improvements, and payback periods for each recommendation for field-level equipment and management activities.	Erosion-wind, sheet and rill, ephemeral gully, irrigation-induced; Soil Condition-organic matter depletion, sediment deposition; Water Quantity-inefficient water use on irrigated land; Water Quantity-inefficient water use on non-irrigated land; Surface Water Quality-pesticides, nutrients, sediment; Air Quality-PM, ozone, GHG.	NO-already done
Combustion System Improvement	CED-ECS	372	Partially replaces Atmospheric Resources Quality Management. Provides for replacement or retrofit of inefficient combustion systems with more efficient systems	Air Quality-greenhouse gases, ozone precursors, particulate matter; Energy efficiency	NO - already done
On Farm Equipment Efficiency Improvements	CED	374	Allows for installation or retrofitting of inefficient agricultural equipment to improve efficiency and reduce GHG emissions.	Air Quality GHG, Energy efficiency	NO
Pumping Plant	CED-WME	533	Efficient pumping plant saves energy	Soil Condition-subsidence; Water quantity-inefficient water use on irrigated or non-irrigated land; Air quality-GHG; Plant condition-productivity, health and vigor; Domestic animals-inadequate stock water, stress and mortality	Has already been done.
Anaerobic Digester	CED-EE	366	Can produce a source of energy, depending on how the practice is used.	Surface Water Quality-nutrients and pathogens, Air quality-Particulate Matter, Greenhouse gasses, ammonia	NO-already done
Irrigation Reservoir	CED-WME	436	Water conservation yields energy conservation	Water Quantity-inefficient water use on irrigated land; Water quality-pesticides, nutrients and organics	DONE- Has purpose "Reduce Energy Consumption"

Irrigation System, Surface and Subsurface	CED-WME	443	Water conservation yields energy conservation	Irrigation-induced erosion; Water Quantity-excessive seepage, runoff flooding or ponding, subsurface water; aquifer overdraft, insufficient flows in water courses, inefficient use of water on irrigated land; Water Quality-surface and groundwater pesticides and nutrients, salinity, pathogens and petroleum; Plant productivity, health and vigor	DONE- Has purpose "Improve Energy Use Efficiency"
Forage and Biomass Planting (Pasture and Hayland Planting)	ECS-Graz Land Sp	512	Can be used to establish bioenergy feedstocks	Soil erosion, soil condition, soil contaminants, plant productivity, noxious and invasive plants, forage quality and palatability, domestic animal quantity and quality fo feed, renewable energy - bioenergy	NO - already done
Roofs and Covers	CED-EE	367	If used in conjunction with capturing methane, can capture a source of energy	Air Quality- Greenhouse Gases	NO (already done)
Residue and Tillage Management, Mulch Till	ESD-Agron	345	Few tillage trips across the field and less horsepower requirements.	Erosion-wind, sheet and rill, ephemeral gully, irrigation-induced; Soil Condition-organic matter depletion, sediment deposition; Water Quantity-inefficient water use on non-irrigated land, Surface Water Quality-pesticides, nutrients, sediment; Air Quality-PM, ozone, GHG; Wildlife food and cover	NO - already done
Residue and Tillage Management, Ridge Till	ESD-Agron	346	Few tillage trips across the field and less horsepower requirements.	Erosion-wind, sheet and rill, ephemeral gully, irrigation-induced; Soil Condition-organic matter depletion, sediment deposition; Water Quantity-inefficient water use on non-irrigated land, Surface Water Quality-pesticides, nutrients, sediment; Air Quality-PM, ozone, GHG; Wildlife food and cover	NO - already done
Tree/Shrub Establishment	ESD-For & CED-LA	612	Reduces energy needed for home and facility heat. Conversion of crop to permanent cover reduces energy needs. Potential biomass energy crop	Soil Erosion; Soil Condition-organic matter depletion; Water Quality-surface and groundwater pesticides and pathogens, sediment; Air Quality-GHG, undesirable air movement; Plant suitability; Plant condition-productivity health and vigor, noxious and invasive plants, forage quality and palatability; Wildlife food and cover, domestic forage	NO
Waste Utilization	ESD-NM & CED-EE	633	Can recycle waste to replace other inputs.	Soil Condition-organic matter depletion; Water Quality	NO-already done

Windbreak/Shelterbelt Renovation	ESD-For	650	Reduces heating around farmsteads, less water stress on crops. Potential biomass.	Soil Erosion-wind; Soil Condition-organic matter depletion; Water Quantity-drifted snow, inefficient water use on irrigated and non-irrigated land; Groundwater Quality-excessive nutrients and organics; Air Quality-chemical drift, odors, visibility, undesirable air movement, adverse air temperature; Plants suitability; Plants Condition-health and vigor, noxious and invasive plants, forage quality; Fish and Wildlife-food, cover, space, habitat fragmentation, population imbalance; Domestic Animals-shelter, stress and mortality	NO-already done
Conservation Power Plant (Interim Practice)		716	Practice provides for renewable energy generation	Air Quality GHG	NO
Conservation Crop Rotation	ESD-Agron	328	Utilize nitrogen carry-over, reduces synthetic nitrogen, improves water utilization, pest management. Degree of benefit will vary significantly.	Erosion-sheet and rill, ephemeral gully, irrigation-induced, wind, Soil quality-organic matter depletion, contaminants, Water Quality-sediment deposition, nutrients, pesticides; Plant adaptation, production; Noxious weeds	YES
Contour Farming	ESD-Agron	330	Less power requirement vs. up and down hill. In many cases the row length will be longer requiring fewer turns, saving time and fuel.	Sheet and Rill erosion; Water Quality-Sedimentation; Water quantity - reduced capacity due to sedimentation	YES
Cover Crop	ESD-Agron	340	Can produce and/or capture nitrogen.	Erosion-sheet and rill, ephemeral gully, irrigation-induced, wind, Soil quality-organic matter depletion, contaminants, Water Quality-sediment deposition, nutrients, pesticides; Plant adaptation, production; Noxious weeds	YES-Identify when energy savings will occur
Irrigation System, Microirrigation	CED-WME	441	Requires less water and lower pressure pumping. Substantially reduces water needs because being applied directly to plant roots.	Irrigation-induced erosion; Water Quantity-excessive seepage, runoff flooding or ponding, subsurface water; aquifer overdraft, insufficient flows in water courses, inefficient use of water on irrigated land; Water Quality-surface and groundwater pesticides and nutrients, salinity, pathogens and petroleum; Plant productivity, health and vigor	YES
Irrigation Water Management	CED-WME & ESD-Agron	449	More efficient use of water, less pumping.	Soil erosion-wind, irrigation-induced; Soil Condition-salts and other chem; Water Quantity-excessive seepage, runoff flooding or ponding, subsurface water; aquifer overdraft, insufficient flows in water courses, reduced capacity of storage; Water Quality-surface and groundwater contaminants; Air Quality-PM; Plant Condition- productivity and vigor, forage quality and palatability	YES

Residue and Tillage Management, No Till/Strip Till/Direct Seed	ESD-Agron	329	Few tillage trips across the field and less horsepower requirements.	Erosion-wind, sheet and rill, ephemeral gully, irrigation-induced; Soil Condition-organic matter depletion, sediment deposition; Water Quantity-inefficient water use on non-irrigated land, Surface Water Quality-pesticides, nutrients, sediment; Air Quality-PM, ozone, GHG; Wildlife food and cover	YES
Alley Cropping	ESD-For	311	Potential biomass production, crop production inputs are reduced	Sheet and rill, wind and ephemeral gully erosion, organic matter depletion, soil contaminants, sediment accumulation in water bodies, plant productivity	YES
Amendments for Treatment of Agricultural Waste	CED-EE	591	Improved handling of agricultural wastes can reduce hauling distance and energy requirements through nutrient tie-up and volume reduction.	Air Quality-particulate matter, ammonium, surface and groundwater quality, domestic animal stress and mortality	YES
Anionic Polyacrylamide (PAM) Application	CED-WME	450	Reduces water pumping and tillage requirements by reducing furrow erosion and sedimentation.	Irrigation induced erosion, wind erosion, reduced conveyance capacity, reduced water storage capacity, surface water quality-pesticides, nutrients and sediment	YES-need to specify when/how energy is saved by this practice.
Composting Facility	ESD-NM & CED-EE	317	Reduce volume/weight for material transport. By-products from this practice can be used in lieu of fossil fuels	Surface and groundwater Quality-nutrients and pathogens, Air quality-volatile organics (odors)	YES
Feed Management	AHCWD-AH	592	Improves diet, reduces manure excretion. Reduces energy needed to transport and utilize manure.	Water Quality-nutrients; Air quality-GHG, particulate matter	YES-if diet can be adjusted to reduce manure nutrient content and reduce hauling distance by improving feed efficiency.
Field Border	ESD-Agron	386	Reduces end-row erosion on cropland and subsequent tillage to eliminate ephemeral erosion. Replaces annual crops with perennial cover. Reduce energy inputs	sheet and rill, ephemeral gully, gully or wind erosion; soil organic matter depletion; and water quality; noxious and invasive plants; wildlife habitat food and cover; plant condition	YES .Explain benefits of field borders for energy conservation. Field borders can be harvested for biomass.
Filter Strip	ESD-Agron & CED-EE	393	Reduces ephemeral erosion and related tillage. Replaces annual crops with perennial cover. Reduced energy inputs.	Water Quality - suspended solids and dissolved pollutants	YES-This practice will only save energy if in-field practices are in place to reduce maintenance requirements for the filter strip. Filter strips can be harvested for biomass.
Forage Harvest Management	ESD- Graz Land Sp	511	Contain criteria for harvesting to maximize biomass for energy production. Reduces need for pesticides, increases biomass yield	Soil condition-compaction; Soil contaminants-nutrients, pesticides; Plant productivity; noxious and invasive plants; forage quality and palatability; domestic animal quantity and quality of feed	YES
Forest Slash Treatment	ESD-For	384	Potential source of biomass materials	Organic matter depletion; Plant condition-plant suitability, plant productivity, forage quality and compatibility, noxious and invasive plants, wildfire hazard; Domestic animals-quantity and quality of feed	YES-Consider utilizing slash as a bioenergy source - how would it be treated in that case?

Forest Stand Improvement	ESD-For	666	Potential source of biomass materials	Water quantity-insufficient flows in water courses; Plant condition-plant suitability, plant productivity, forage quality and compatibility, noxious and invasive plants, wildfire hazard; Domestic animals-quantity and quality of feed	YES-Consider utilizing forest thinnings as a bioenergy source - how would it be treated in that case?
Irrigation Canal or Lateral	CED-WME	320	Water conservation yields energy conservation. Practice facilitates gravity flow irrigation	Water Quantity-inefficient water use on irrigated land	YES
Irrigation Field Ditch	CED-WME	388	Water conservation yields energy conservation. Practice facilitates gravity flow irrigation	Water Quantity-inefficient water use on irrigated land	YES
Irrigation System, Sprinkler	CED-WME	442	Water conservation yields energy conservation	Irrigation-induced erosion; Water Quantity-excessive seepage, runoff flooding or ponding, subsurface water; aquifer overdraft, insufficient flows in water courses, inefficient use of water on irrigated land; Water Quality-surface and groundwater pesticides and nutrients, salinity, pathogens and petroleum; Plant productivity, health and vigor	YES
Irrigation System, Tailwater Recovery	CED-WME	447	Water conservation yields energy conservation	Water Quantity-inefficient use of water on irrigated land, inadequate outlets, reduced capacity of conveyances by sedimentation, reduced storage of water bodies;; Water Quality-surface water pesticides, nutrients, heavy metals; Plant productivity, health and vigor	YES
Irrigation Ditch Lining	CED-WME	428	Gravity fed is energy efficient but water inefficient. Lining reduces water losses.	Water Quantity-inefficient water use on irrigated land, insufficient flows in water courses; Water Quality-salinity in groundwater; Plant productivity and vigor	YES
Irrigation Pipeline	CED-WME	430	Water conservation yields energy conservation	Water Quantity-inefficient water use on irrigated land; Water Quality-salinity in groundwater; Plant productivity and vigor	YES
Mulching	ESD-Agron	484	Potential reduction in the use of petroleum-based agrichemicals for weed control and pumping for irrigation	Soil Erosion (all types); Soil Condition-Organic Matter; Water Quantity-inefficient water use or irrigated or non-irrigated land; Water Quality-contaminants in surface water; Plant Condition-productivity, health and vigor; noxious and invasive plants	YES
Nutrient Management	ESD-NM & CED-EE	590	Better timing and placement to reduce rates - less nitrogen used.	Water Quality-excessive nutrients and organics in surface or groundwater, heavy metals in surface water; Air Quality-PM, ozone, GHG, odors; Plant suitability, productivity health and vigor	YES
Pipeline	CED-DE	516	More energy efficient transport for livestock water.	Domestic Animals-Inadequate stock water, stress and mortality; Plant Condition- plant production health and vigor	YES

Prescribed Burning	ESD-For	338	Reduces energy requirements for firefighting and pest control.	Plant Suitability; Plant condition-productivity, health and vigor, noxious and invasive plants, forage quality and palatability, wildfire hazard; Fish and Wildlife-inadequate food, cover and/or shelter; Domestic Animals-quality and quantity of feed and forage	YES
Prescribed Grazing	ESD-Graz Land Sp	528	less energy-intensive vs. other feed sources such as harvested hay, grain, etc.	Soil erosion; Soil Condition- organic matter depletion, range site stability, compaction; Range Hydrologic Cycle; Plant Suitability; Plant Condition-productivity, health and vigor; noxious and invasive plants, forage quality and palatability, wildfire hazard; Fish and Wildlife-inadequate food and cover; Domestic Animals-inadequate forage quality and quantity, inadequate shelter, stress and mortality	YES
Riparian Forest Buffer	ESD-For & CED-LA	391	Reduced energy due to conversion of crop to permanent cover. Reduced energy due to ephemeral gully erosion management. Potential for biomass product.	Soil Condition-organic matter depletion, contaminants; Water Quantity-reduced capacity of conveyance or storage due to sedimentation; Ground Water quality-nutrient contamination; Surface Water Quality-pesticides, nutrients, sediment, temperature; Air Quality (GHG); Plant Suitability; Plant productivity health and vigor, noxious and invasive weeds, Fish and Wildlife food, cover (esp aquatic),	YES-If Riparian Forest Buffer is to supply biomass for energy, species selection and harvest plan should account for the rate of production, reduced sequestration, and other specified purposes
Riparian Herbaceous Cover	ESD-Wbio	390	Reduced energy due to conversion of crop to permanent cover. Reduced energy due to ephemeral gully erosion management. Potential for biomass product.	Shoreline erosion; Soil condition-organic matter depletion, rangeland site suitability, compaction, contaminants; Water Quantity-rangeland hydrologic cycle, reduced conveyance and/or storage capacity due to sedimentation, insufficient flows in water courses; Surface and groundwater quality-nutrients; Plant productivity; Plant suitability, Plant productivity health and vigor, noxious weeds, forage quality and palatability; Wildlife food and cover; Domestic animals-quality and quantity of feed and forage	YES-If Riparian Herbaceous Buffer is to supply biomass for energy, species selection and harvest plan should account for the rate of production, reduced sequestration, and other specified purposes

Silvopasture Establishment	ESD-For & Graz Land Sp	381	Potential biomass production.	Soil Erosion-sheet and rill, ephemeral gully, wind, streambank, shoreline; Soil condition-organic matter depletion; Surface Water Quality-suspended sediment; Air Quality-GHG; Plants suitability; Plant Condition-Productivity health and vigor, noxious and invasive plants, forage quality and suitability, wildfire hazard; Fish and Wildlife-food, shelter, population imbalance; Domestic Animals-quality and quantity of feed and forage, inadequate shelter, stress and mortality	NO
Solid/Liquid Waste Separation Facility	CED-EE	632	Reduce volume/weight for material transport	Surface and Groundwater Quality-excessive nutrients and organics; Air Quality-GHG, ammonia, odors	YES
Tree/Shrub Pruning	ESD-For	660	Potential biomass for energy and improves yield in the long-term.	Plant condition-productivity health and vigor, wildfire hazard	YES-Branches removed may be used for other products, including bioenergy
Waste Facility Cover	CED-EE	367	If used in conjunction with capturing methane, can capture a source of energy	Air Quality- Greenhouse Gases	YES
Waste Transfer	CED-EE	634	Transferring manure with gravity can save energy by limiting pumping requirements	Surface Water Quality-nutrients and pathogens,	YES - provide a waste transfer mechanism that uses gravity flow to save energy.
Waste Treatment	CED-EE	629	Save more nitrogen, requires less synthetic nitrogen. Waste treatment to tie up phosphorus allows for higher application rate and reduced transport requirements	Surface and groundwater Quality-nutrients and organics; Air Quality-PM, Greenhouse Gases	YES
Waste Treatment Lagoon	CED-EE	359	Use in concert with cover to capture methane	In conjunction with cover: Air Quality-Greenhouse Gases	NO-already done
Windbreak/Shelterbelt Establishment	ESD-For	380	Reduces heating around farmsteads, less water stress on crops	Soil Erosion-wind; Soil Condition-organic matter depletion; Water Quantity-drifted snow, inefficient water use on irrigated and non-irrigated land; Groundwater Quality-excessive nutrients and organics; Air Quality-chemical drift, odors, visibility, undesirable air movement, adverse air temperature; Plants suitability; Plants Condition-health and vigor, noxious and invasive plants, forage quality; Fish and Wildlife-food, cover, space, habitat fragmentation, population imbalance; Domestic Animals-shelter, stress and mortality	YES-If windbreak is to supply biomass for energy, species selection, placement and a harvesting plan need to ensure that other purposes are not unduly compromised. Recognize that carbon sequestration rates will be reduced when windbreak trees are used for bioenergy.

<b>Future Interim Standards currently under development</b>					
Electric Controls for greenhouses					
Greenhouse HAF system					
Root zone heating for greenhouses					
Greenhouse shades					