

Measure 3: Incentives for Irrigation Well Conversion from Diesel to Electric

Measure Concept

Provide financial incentives (rebates) to farmers to replace diesel engines powering irrigation well pumps with electric motors/pumps connected to the electric grid, with a goal of funding 50 engine replacements per year from 2025 through 2030. The incentives would cover a percentage of the costs of new electrical equipment, wiring and installation, and utility upgrade and connection charges.

Description and Background

Nebraska's agricultural economy is highly dependent on groundwater to irrigate crops such as corn, soybeans, and edible beans. As of November 2023, the state had over 96,000 active irrigation wells registered, and previous surveys have indicated at least 24% of well pumps were still powered by diesel engines. Replacement of these diesel engines with electric motors connected to the electric grid can reduce GHG and other emissions and save farmers money in the long term due to the low cost of electricity in Nebraska compared to fuel costs as well as reduced maintenance costs. However, the up-front capital costs for the conversion can be a barrier to adoption. The financial incentives provided by this program are expected to spur more widespread adoption.

This is an electrification measure designed to replace fossil fuel combustion at the well location with electricity from the grid, some portion of which is produced from sources other than fossil fuel combustion (nuclear, wind, and solar). This measure is distinct and independent from the agricultural programs in Measure 6, which provide incentives for farmers to change practices in several ways to reduce tillage and fuel use, rebuild soil health to improve long-term yield and sequester carbon in the soil, and reduce application of nitrogen fertilizer. NDEE expects that at least 30% of the project locations will be in low-income and disadvantaged areas, based on results of the pre-existing program.

Farmers undertaking these projects work with an irrigation service company, which assesses the wellsite (state of well, depth to water, required pumping rate) to determine needed physical modifications to the well (e.g., new headshaft) and the optimal size (horsepower rating) of the replacement electric motor. In some cases, variable frequency drives are installed to adjust the flow pressure by controlling the frequency of the electrical current, achieving significant power savings. Installation of the pump panel and underground wiring is done either by the irrigation company or a separate electrical contractor. In cases where three-phase power is not already in place, the electric utility constructs overhead lines to the field boundary along with a transformer.

Administration

NDEE will administer this program directly. It will be an expanded version of the Department's current irrigation engine rebate program that has been funded since 2017 through the annual state DERA allocation supplemented by Nebraska's Volkswagen Trust fund. New irrigation engine projects will be administered solely through this CPRG implementation grant during fiscal years 2025 through 2029, allowing annual DERA and remaining supplemental Volkswagen Trust funds to be used for diesel vehicle replacements during that time period.

The program will provide rebates to farmers to reimburse 60% of the cost of a new electric motor, wiring and installation, required well work, and required electrical infrastructure (including electric utility charges) up to a maximum reimbursement set annually by the Department. These rebates will be treated by NDEE as participant support costs. The diesel engine owner is responsible for the remainder

of the project costs (recipient cost-share). No part of the recipient cost-share can be provided by any other federal grant program (such as the USDA REAP program). However, replacement incentives offered by the electric service provider may be used to cover a portion of the recipient cost-share. Recipients that receive the scrap value of their disabled diesel engine from a scrap yard must report that amount as program income as part of their reimbursement request, but they will be allowed to apply that amount to their recipient cost-share.

The reimbursement cap applied by NDEE avoids reimbursing excessive utility costs for longer-distance electric service line buildout. We plan to set the reimbursement cap at \$23,000 for the first funding cycle beginning in fall 2024. Projects that do not include large utility costs should receive full 60% reimbursements below the cap. However, for some higher-cost projects a 60% reimbursement would exceed the reimbursement limit, so these projects would receive reimbursement of less than 60% of the project costs. With the proposed cap of \$23,000 and considering historic project costs, we expect that the average rebate will be \$20,000, and that rebates will cover approximately 50% of aggregate project costs.

Eligibility

- Any farming operation that owns a diesel engine powering an agricultural irrigation pump located in Nebraska will be eligible to apply for one irrigation engine replacement per year.
- The applicant must have owned the engine to be replaced for at least two years prior to submission of the application.
- The applicant must be in compliance with all Nebraska environmental laws and with the Department's regulations and permits at all Nebraska locations.
- The diesel engine must be in operating condition and have operated at least 250 hours each year during the two years prior to applying. There are no restrictions on engine model year.
- The diesel engine must have a remaining service life of at least three years in the owner's estimation.

Project Requirements

- The diesel irrigation engine must be replaced by an electric motor or by connecting an existing submersible pump to the electric grid.
- The replacement equipment must operate in the same location as the replaced engine.
- Electrical work must be performed by a licensed electrical contractor.
- The replaced diesel engine must be disabled within 90 days of replacement by cutting or drilling a 3-inch by 3-inch hole through the wall of the engine block into the piston area.
- Awardees must sign a project agreement with the Department outlining the project requirements prior to initiating work.
- Only expenses incurred after the signed agreement is received are eligible for reimbursement.

Application

Applicants will submit the following information on or attached to the application form:

- Diesel engine information: manufacturer, model year, serial number, EPA Engine Family (if available), and horsepower rating.
- Photos of the wellsite, the diesel engine, and any plates with the engine serial number and emissions information

- Location of the engine: county, township, range, section, and quarter-section
- Primary fuel (must be diesel), and annual fuel consumption for the previous two years
- Annual hours operating in each of the previous two years
- Documentation of fuel use and operating hours for the previous two years if available
- Estimate of remaining years of service (minimum 3 years)
- One set of dated quotes for the replacement electric motor and electrical equipment, installation, and electrical utility costs.

Applicant Selection

All applications that meet the eligibility requirements and provide the required information will be considered for an award. If the number of eligible applications exceeds the funding allocated for the project year, preference will be given to applications for project locations within low-income disadvantaged communities as designated by the Climate Pollution Reduction Grant program and to applicants who have not previously received an irrigation engine rebate from NDEE.

Reimbursement

Upon satisfactory completion of the project, NDEE will reimburse the recipient 60% of the project costs up to the stated annual maximum rebate. A request for reimbursement must be made using the form provided by NDEE and must include:

- Manufacturer, model number, and serial number of the replacement electric motor
- Name, address, phone number, and email address for all vendors and the cost of the equipment and/or service provided
- Copies of all invoices and proof of payment for each (copy of canceled check front and back, bank statement showing dates cleared, or credit card statement)
- Photos of the wellsite and the new equipment, including close-up photo of the electric motor and of the motor serial number plate (if applicable)
- Completed Certification of Engine Scrappage Form signed by the engine owner and party who completed the scrappage
- Photos of the diesel engine before and after scrappage.

The information submitted in the reimbursement request is used to verify completion of the project and conformance with the program requirements. Each applicant's application, agreement, and reimbursement request are archived in the Nebraska's Electronic Content Management system as public records.

Project Agreement

Before commencing work, successful applicants must sign a Project Agreement that codifies all of the program requirements listed above. The agreement also includes applicable Federal Requirements from the EPA Terms and Conditions along with standard Nebraska state government requirements.

Annual Federal Fiscal Year Program Timeline

The irrigation engine replacement program will hold annual application periods beginning in October 2024, for a total of five annual project cycles from FFY 2025 through 2029. Most individual irrigation engine replacement projects should be completed within a 12-month period, but some may experience

delays until after the subsequent harvest if utility work and equipment installation cannot be completed prior to spring planting.

Annual Milestone Date Commencing FFY 2025	Task Description
October 1	NDEE opens application period, posting program information and application. Publicize program via press release, social media, and statewide & regional contacts.
December 15-31	Review of applications, selection and notification of awardees.
January	Project agreements provided to awardees; Commence Work notifications sent when signed. In most cases notification timing should allow time for work to be completed before spring planting.
February – September	Recipients carry out projects; NDEE answers questions as needed. Recipients submit reimbursement requests and documentation of activities and expenses. Reimbursements issued by NDEE after receipt and review of complete documentation. Project extensions may be granted if work cannot be completed within the one-year timeframe due to supply issues or utility construction schedules.

Program Timeline and Targets

NDEE proposes to replace an average of 50 irrigation engines annually from FFY 2025 through 2029.

In years when both DERA and VW funds were available, NDEE has completed between 20 and 41 irrigation engine replacements annually since 2018, averaging 28 projects per funding cycle. In some years the number of projects was constrained by funding limits; the highest number of eligible applications received in a year was 49. We anticipate that the publicity surrounding this implementation grant, and in particular Measure 6, will draw more public attention to the irrigation engine program and increase participation to the target of 50 projects each year. The planned increase in the maximum reimbursement from \$20,000 to \$23,000 will also make participation more attractive.

Federal Fiscal Year	Projects Completed	Tasks and Milestones
2025	50	October 2024: Grant awarded. Open yearly project application period. March 2025: Submit Semiannual Report to EPA.
2026	50	October 2025: Open yearly project application period. Submit Semiannual Report to EPA including LIDAC Benefit Analysis. March 2026: Submit Semiannual Report to EPA.
2027	50	October 2026: Open yearly project application period. Submit Semiannual Report to EPA. March 2027: Submit Semiannual Report to EPA.
2028	50	October 2027: Open yearly project application period. Submit Semiannual Report to EPA. March 2028: Submit Semiannual Report to EPA.
2029	50	October 2028: Open yearly project application period. Submit Semiannual Report to EPA. March 2029: Submit Semiannual Report to EPA.

2030	0	January 2030: Submit Final Grant Report to EPA.
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Expected Outputs and Outcomes

Outputs/ Performance Measures	Outcomes / Projected Environmental or Programmatic Improvement
# of replacements Age and operating characteristics of engines Semi-annual progress reports and final report	Reduction in metric tons CO ₂ e in LIDAC Reduction in metric tons CO ₂ e Reduction in criteria air pollutants (CAP) Reduction in CAP in LIDAC Semi-annual progress reports and final report

Greenhouse Gas Emissions Reductions

This measure will replace diesel irrigation engines with electric motors. Replacement and scrapping of diesel engines eliminates emissions at the wellsite, but these reductions are partially offset by emissions from generation of the electricity needed to power the replacement motors, resulting in net reductions that are less than the direct reductions (net emissions reductions = direct emission reductions minus generation emissions).

NDEE calculated the direct emission reductions from engine replacement, the average annual electricity usage needed for the replacement motors, and the emissions from corresponding electricity generation and transmission. The calculations and complete explanations of the methodology for this measure are presented in the *M3-Irrigation-Eng-1* and *M-3-Irrigation-Eng-2* sheets in the GHGcalcs_NebraskaDEE.xlsx workbook. A summary of the methodology is presented below.

Methodology

Direct emissions reductions of CO₂, CH₄ and N₂O from engine replacement were calculated using the average annual diesel fuel use from 138 previous projects from 2018-2022 and emission rates from the EPA Greenhouse Gas Emission Factor Hub: (<https://www.epa.gov/climateleadership/ghg-emission-factors-hub>). Direct emissions reductions of NO_x were calculated from the average historic engine data (horsepower, annual operating hours, and diesel fuel use) using the EPA online Diesel Emissions Quantifier (<https://cfpub.epa.gov/quantifier/index.cfm?action=main.home>). Annual direct emissions reductions for greenhouse gases at the wellsite for the average engine replacement were calculated to be 49.36 metric tons annually, and 0.39 tons annually for NO_x.

To begin estimating the offset emissions from electricity generation, the annual electricity use per motor was calculated from the annual average operating hours (968) and average electric motor horsepower (85 hp = 63.41 kW) of the previous projects, yielding annual single motor electricity usage of 61.38 MWh. Emissions from generation of this electricity in Nebraska were estimated from 2025 through 2050 for each pollutant from the mean of emission rates provided in two representative National Renewable Energy Laboratory 2023 Standard Scenarios of electric grid emission rates from 2025 through 2050 (see previous workplan section on projections methodology for measures impacting grid electricity). These scenario rates were also used to project the cumulative net emissions for this measure through 2050. The calculated single engine-project annual emissions from electricity generation in 2025 were calculated to be 21.96 metric tons for greenhouse gases and 0.37 ton for NO_x.

The net emissions reductions per project in 2025 are therefore 27.4 metric tons of greenhouse gases and 0.02 metric tons of NOx. Using the NREL Standard Scenarios, these net reductions are modeled to increase somewhat by 2030 due to decreased fossil fuel generation of electricity in the region.

Cumulative Net Emissions Reductions for 50 irrigation engine projects per year 2025-2029					
	Net GHG Emissions Reductions (MT CO ₂ e)	Net CO ₂ Emissions Reductions (MT)	Net CH ₄ Emissions Reductions (MT CO ₂ e)	Net N ₂ O Emissions Reductions (MT CO ₂ e)	Net NOx Emissions Reductions (MT)
2025	1,098	1,148	(80)	30	19
2026	3,712	3,833	(212)	91	57
2027	8,327	8,510	(370)	187	114
2028	9,820	10,407	(883)	296	187
2029	19,023	19,618	(1,055)	460	283
2030	28,581	29,159	(1,204)	626	379
2050	249,803	248,049	(2,307)	4,061	2,331
Cumulative Net Emissions Reductions attributed to 50% Grant Funding:					
2030	14,291	14,580	(602)	313	190
2050	124,901	124,024	(1,154)	2,031	1,166

Longevity and Durability of GHG Reductions

Conversion of an irrigation well from a diesel engine to electric requires a significant investment in equipment and often in electrical infrastructure. Once this investment in conversion is made, and an electrical connection is available at the site, it is highly unlikely that the well would revert to power from a diesel engine in the future. Even if the life expectancy of the specific electrical equipment (motor, panel) would be less than 25 years, we would expect that replacement equipment would be supplied by the owner to maintain overall cost savings, which would maintain the emissions differential documented here for electric versus diesel power for the well. Thus, NDEE expects that this measure will produce permanent emissions reductions through the grant period and to 2050.

Cost-Effectiveness

As noted above in the Administration section, this measure offers a 60% reimbursement of project costs but sets a maximum reimbursement amount (\$23,000 for project year 1). This means that higher-cost projects will receive less than 60% reimbursement. Based on costs from previous projects, we expect that the proposed rebate limit will result in an average rebate of \$20,000 and that rebates will cover approximately 50% of the aggregate project costs.

NDEE has budgeted \$6,140,507 for Measure 3 to achieve a cumulative 14,291 metric tons of greenhouse gas reductions (attributed to 50% grant funding).

The resulting cost-effectiveness of this measure is therefore \$429.67 per metric ton of CO₂e emissions reduced.

Budget

Category	Budget	Narrative
Personnel	\$209,550	Estimated at 0.70 FTE per year. Includes portions of salary of full-time staff to perform tasks including managing the grants and awards and participating in the day-to-day activities of the program administration; preparing reports; conducting on-site compliance, monitoring visits, and program inspections and documents findings; and program outreach and presentations. Reviewing and approving reimbursement requests and documentation.
Fringe Benefits	\$66,532	Includes taxes, medical insurance, retirement, and other non-salary expenses estimated as a percentage of salary. The current rate for Fringe Benefits is 31.75%.
Travel	\$5,081	Includes costs for mileage, vehicle rental, meals, and lodging necessary to implement the program and to oversee projects. Costs are estimated annually for staff travel to project site visits. Costs are estimated for 1000 miles per year of travel to conduct sub-recipient monitoring of activities and project site visits, and 2 overnight stays, 4 travel days for 1 staff per year.
Equipment	\$0	EPA definition of equipment is any item over \$5,000. There is no anticipated additional equipment needed to implement these activities.
Supplies	\$0	Includes usual office and laboratory materials necessary to implement tasks. Office supplies are considered part of this category also and include things such as furniture, staff desk supplies and computers.
Contractual	\$25,000	Contractual work for a grant management system via subscription service to develop an electronic application database for application to submit their application, track their project status, submit required reports, and track reimbursement. NDEE will also use this system to track expenditures and project metrics.
Other	\$5,750,000	Participant Support Costs: Irrigation Engine Replacement Rebates, 50 replacements/yr @ \$23,000 each. NDEE would implement an annual program soliciting applications and awarding projects to applicants, with a goal of awarding funds for at least 50 engine replacement projects to be completed within each program year. The program design would follow and expand upon the existing program funded by an annual EPA DERA (Clean Diesel) grant. Assumes cost share of 50%.
Total Direct Charges	\$6,056,163	
Indirect Charges	\$84,344	40.25% Calculated as a percentage of salary cost (approved FY24 rate)
<u>TOTALS</u>	\$6,140,507	