

Welcome

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New Emp

Priority --

Instructio

Tab A is t

Use Tab B

See Tab C

Please inc
Applicatic

!

Rural Utilities Service (RUS) Greenhouse Gas (GHG) Calculator for Utility-Scale Renewable Energy Projects Generating

Calculator is to be used by applicants to the Inflation Reduction Act (IRA)

Powering Rural America (New ERA) - SEC. 22004. USDA ASSISTANCE FOR RURAL ELECTRIC COOPERATIVES

To achieve the greatest reduction in carbon dioxide, methane, and nitrous oxide emissions associated with rural

ns

The purpose of this workbook is to provide a simple GHG calculator that will allow RUS to estimate emission reductions in a manner that allows for a direct comparison of Section 22004 applications on an equal or "apples-to-apples" basis. It is intended to reduce the burden on applicants from having to learn or develop a new tool or program in order to apply for this program.

There are many valid methods to calculate achievable GHG emission reductions. This workbook may not capture all conditions an applicant is proposing, such as emission reductions from transmission and distribution loading changes, storage reductions, or other dynamic system reductions. If there are other "zero emission systems" or other emission reduction systems that you believe will be adequately captured in the spreadsheet, applicants are welcome to note that and provide that information. "Zero emission systems" must generate electricity and be completed and operating by 2031.

Again, the purpose of this spreadsheet is to allow for a simplified manner for applicants to outline their plans and forecasts on a standard basis using common assumptions. Section 22004 includes the following as eligible activities: the purchase of renewable energy systems, zero-emission systems, carbon capture and storage systems, to deploy such systems, or other improvements to generation & transmission system of eligible entities. For purposes of this spreadsheet, both renewable and nuclear are considered to be "zero emission systems" and are delineated as separate inputs.

The GHG Calculator Worksheet

The Calculator Worksheet is to be used by all eligible section 22004 applicants.

The Worksheet uses the latest system data provided by the applicant (either 2021 or 2022) as a baseline to calculate emissions (reductions and avoided). Other related metrics are calculated.

Projects and impacts should reflect the scope of your proposal for funding and be a direct result of the requested funding.

The Calculator Worksheet provides a snap shot of the annual GHG impacts assuming all aspects of the proposed project. All inputs are average annual values.

This Worksheet allows the assessment of project impacts based on a common and consistent set of assumptions.

Enter your system and project data in the gray cells. The Worksheet's calculated values and metrics are in the green cells.

If "ERROR" flags appear, please check and reenter your input values.

Instructions:

Step 1. Identification Inputs: Eligible Entity Legal Name (Applicant) ; Project Name; and Date

Step 2. Part 1 Inputs to establish baseline year energy supply mix

Select: Baseline Year

Input: Total Generated Energy and its breakdown as specified

Input: Total Energy Purchases and its breakdown as specified

Input: Total System Grid Losses

Step 3. Part 2 Proposed Project(s) Data

Input: Proposed Project(s) Total Capital Cost and Total RUS Loan and Grant Funds Being Requested in this Application

Input: Additions of New Zero Emission Generation and Purchases

Enter Sum of All New Proposed Zero Emission Generation (MWh) and Sum of All New Zero Emission Electricity Purchases

Input: Phase Down of Non-Zero Emission Generation Assets

Enter Sum of the Non-Zero Emission Generation (MWh) Attributed to Stranded Assets and Green Fuel Switching

Input: Useful Life and Purchase Terms for New Non-Zero Emission Supply

Input: Carbon Capture and Sequestration and Useful Life

Input: Reduction in Annual System Grid Losses

Input: Share of New Zero Emission Generation Applied to Phased Down Non-Zero Emission Generation

Input: Share of New Zero Emission Purchases Applied to Phased Down Non-Zero Emission Purchases

Step 4. All values for the new energy supply mix are calculated

Step 5. All Greenhouse Gas Metrics are calculated

Step 6. Check Calculator Worksheet for "ERROR" flags. Check and reenter your input values as needed.

Step 7. Save Workbook and submit with application

How to provide any additional Notes or Feedback concerning system impacts and benefits

Describe system portfolio impacts not captured by the calculator and how the proposed projects fit into your decarbonization strategy (e.g., net zero carbon by 2035)

Other qualitative benefits can be presented.

How to review the base GHG Emission Factors Used in this Workbook

GHG Emission Factors are referenced from eGRID, U.S. Environmental Protection Agency (EPA) and the Energy Information Administration (EIA) National Average Factors are used for simplicity and consistency.

Include your completed Workbook in your loan application package. Thank you!

Applications will not be deemed complete if this worksheet or an equivalent substitute is not included in the submitted application package.

**UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)
RURAL UTILITIES SERVICE (RUS) ELECTRIC PROGRAM**

ELIGIBLE ENTITY LEGAL NAME:

PROJECT NAME:

DATE:

This worksheet is for all eligible New ERA (Section 22004) electric cooperative ap

- ★ Adding zero emission systems (renewable-based or nuclear energy)
- ★ Projects directly facilitate the phase down of existing non-zero em
- ★ Adding zero emission based purchases and eliminating or reducing
- ★ Installing carbon capture and sequestration facilities
- ★ System grid improvements

For applicants that are eligible electric cooperative subsidiaries, Part 1 inputs req
All data inputs are either positive values or 0. Negative values are not valid entri

PART 1. Inputs to Establish a Baseline Energy Supply Mix and Determine the B

Generation System Data (2021 or 2022) – Based on Generating Assets You Curre

Note: For Subsidiary Applicants, this section describes your offtaker's system.

Annual Total System Generation Supply (MWh)

Assets Owned and Operated

Annual Renewables Generation (MWh)

Annual Coal Generation (MWh)

Annual Natural Gas Generation (MWh)

Annual Oil/Diesel Generation (MWh)

Annual Nuclear Generation (MWh)

Purchased Electricity

Total Annual Electricity Purchases (MWh)

Annual Renewables Purchases (MWh)

Annual Coal Generation Purchases (MWh)

Annual Natural Gas Generation Purchases (MWh)

Annual Oil/Diesel Generation Purchases (MWh)

Annual Nuclear Generation Purchases (MWh)

Annual Bulk Grid Purchases (MWh)

System Grid Losses

Annual System Grid Losses (MWh)

PART 2. Proposed Project(s) Data: Provide Project Cost and Impacts to the Sys

Total Project Capital Cost (\$)

Requested RUS Amount (\$)

Actions Directly Funded By this Project - Average Annual Values - All Projects N

Additions of Zero Emission Generation and Purchases

Proposed New Renewable Project(s) Average Annual Generation (MWh)

Include the sum of all new renewables-based electricity generation (direct to grid and

Proposed New Nuclear Project Annual Generation (MWh)

Proposed New Renewables Power Purchases (MWh)

Proposed New Nuclear Generation Power Purchases (MWh)

Phase Down of Non-Zero Emission (Fossil) Generation Assets (Stranded Assets

Proposed Phase Down of Coal Asset Generation (MWh)

Proposed Phase Down of Natural Gas Asset Generation (MWh)

Proposed Phase Down of Oil/Diesel Generation (MWh)

Carbon Capture and Sequestration

Anticipated Annual Tons of CO2e Captured/Sequestered

Reduction of System Grid Losses

Anticipated Annual Reduction of System Grid Losses (MWh)

In Tab B, please specify the names of the fossil units being permanently closed, f

In Tab B, please specify if System Grid actions increase the power transfer capac

Operational Impacts on the Baseline System - Uses of the Proposed New Zero I

Additions and Replacements: What share of the zero emissions projects' outp

Replacement is defined as the portion of ne

Total New Zero Emission Supply (MWh)

Table 1. Proposed Project(s)	Total New Zero Emission Supply (MWh)
Breakdown of New Zero Emission Supply (MWh)	Renewables
Generation	-
Purchases	-
Total	-

Uses of Zero Emission Supply (MWh): Allocation New Zero Emission Supply (T

Table 2. Proposed Project(s)	Share of New Zero Emission Generation Ap
Breakdown of New Zero Emission Supply (MWh)	Renewables

Coal Generation	
Nat Gas Generation	
Oil/Diesel Gen	
Total	-
Cannot Exceed	-
Remaining ZE Gen	-

Table 3. Proposed Project(s) Share of New Zero Emission Purchases Applied	
Breakdown of New Zero Emission Supply (MWh)	Renewables
Coal Gen Purchases	
Nat Gas Purchases	
Oil/Diesel Purchase	
Bulk Grid Purchases	
Total	-
Cannot Exceed	-
Remaining ZE Purchases	-

Additional Bulk Grid Purchases Necessary to Replace Any Phased Down Non-ZE

Table 4. Proposed Project(s) Remaining New Zero Emission Supply to be	
Breakdown of New Zero Emission Supply (MWh)	Renewables
Generation	-
Purchases	-
Total	-

Table 5. Summary	
Total Zero Emission Supply (MWh)	
Amount Applied to Non-Zero Emission Phase Downs (MWh)	
Amount Applied to System Growth (MWh)	

New System Supply Mix

Summary of Proposed Project(s) Output and Uses:

Zero Emission System Gen and Purchases to Meet Growth

Additional Renewables Supply

Additional Nuclear Supply

Zero Emission Gen and Purchases Applied to Phased Down Non Zero Emission

Replacement of Coal Generation

Replacement of Natural Gas Generation

- Replacement of Oil/Diesel Generation
- Zero Emissions Gen and Purchases Applied to Non Zero Emission Purchased Po**
- Replacement of Purchased Bulk Grid Electricity
- Replacement of Purchased Coal Electricity
- Replacement of Purchased NG Electricity

Generation output reduced by fossil phase down that is not replaced with zero e

PART 3. Calculated GHG Emissions (Based on EPA eGrid Emission Factors Present)

System Supply Mix

Zero Emission Systems

- Renewables Generation/Total Generation Supply (%)
- Nuclear Generation/Total Generation Supply (%)

Legacy Fossil Generation Assets

- Coal Generation/Total Generation Supply (%)
- Natural Gas Generation/Total Generation Supply (%)
- Oil/Diesel Generation/Total Generation Supply (%)

Energy Supply Purchases

- Bulk Grid Purchases/Total Generation Supply (%)
- Coal Generation Purchases/Total Generation Supply (%)
- Natural Gas Generation Purchases/Total Generation Supply (%)
- Renewable Generation Purchases/Total Generation Supply (%)
- Nuclear Generation Purchases/Total Generation Supply (%)

Total must add to 100%

Current Annual GHG (Tons)

CO2	-
N2O	-
CH4	-

Current

Annual CO2 Equivalent (CO2e) (Tons) -

Lifetime Cumulative CO2e (Tons) -

System Carbon Intensity (pounds CO2e/MWh)

Current System -

System + Project(s)	-
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PART 4. Calculated Metrics

Annual Metrics

Note 1:	Annual GHG Reduction (Tons CO2e)	-
	Annual GHG Avoided (Tons CO2e)	-
	Annual Tons Reduced and Avoided	-

		System + Project(s)
Note 1:	Annual GHG % Reduction	0.0%
	Decrease % in Carbon Intensity	0.0%
	Increase % of Renewables Supply	0.0%
	Increase % of Zero Emission Supply	0.0%

Project Lifetime Metrics (Cumulative Impacts)

Note 1:	Total GHG Reduction (Tons CO2e)	-
	Total GHG Avoided (Tons CO2e)	-
	Total Tons Reduced and Avoided	-

		System + Project(s)
Note 1:	Lifetime GHG % Reduction	0.0%

Note 1: If new renewable projects only provide additional generation for growth
 In this case, use GHG avoided metrics only. Carbon Intensity values and



Applicants who are proposing to use RUS IRA funding for any of the following:
 (a) new zero-emission generation) to their utility plant assets, rate-based generation fleet (owning new zero-emission generation from the asset base
 (b) fossil-based and grid purchases

represent their offtaker's system.
 details.

Baseline System GHG Emissions

entirely Own and Operate and Electricity Purchases. For assets you have partial ownership

Baseline Year:

All proposed projects must be in operation after the baseline year

Does not include proposed project(s). Includes all owned generation and purchases in

Sum of all renewable sources for electricity generation in the baseline year

All Electricity Purchases (All supply contracts, bulk grid, and PPAs)

<input type="text"/>	Renewables Share of Total Purchases (Not in Addition to Total F
<input type="text"/>	Coal Share of Total Purchases (Not in Addition to Total Purchase
<input type="text"/>	Natural Gas Share of Total Purchases (Not in Addition to Total P
<input type="text"/>	Oil/Diesel Share of Total Purchases (Not in Addition to Total Pur
<input type="text"/>	Nuclear Share of Total Purchases (Not in Addition to Total Purc
<input type="text"/>	Grid Purchase Share of Total Purchases (Not in Addition to Tota

Check of Total Purchased Electricity: - MWh

Check of Total System Supply: - MWh

tem Energy Supply Mix and GHG Emissions

Include total requested RUS loan and grant amounts in this application

Must Be Complete and Operational By 2031

renewable electricity stored and dispatched).		Useful Life (years)	
		Do not double count delivered generation.	
	-	Useful Life (years)	
		Purchase Term (yr)	
and Green Fuel Switching or Cofiring)		Purchase Term (yr)	
		Weighted Avg Life	
	-	Useful Life (years)	
		Net MWh Line and Delivery <u>Savings</u>	

fuel type, and MW nameplate capacities.

ity of the system grid and enables interconnections or delivery of additional renewable

Emission Project(s) Generation and Purchases

ut is additional generation (system growth) and what shares replace the phased out nc
w zero emission project(s) that maintains the output provided by the baseline system :

Nuclear	Total	Check
-	-	-
-	-	-
-	-	-

able 1) to Replace Supply from Phasing Down Non-Zero Emission Supply Sources

Applied to Phased Down Non-Zero Emission	Generation (MWh)
Nuclear	Cannot Exceed
Total	

-	-	-
-	-	-
0	-	-
-	-	-
-		
-		

Applied to Phased Down Non-Zero Emission Purchases (MWh)

Nuclear	Total	Cannot Exceed
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-		
-		

Zero Emission Supply that Was Not Covered by the New Zero Emission Supply (MWh)

-

Used for System Growth (MWh)

Nuclear	Total
-	-
-	-
-	-

-	
MWh)	-
	-

Supply	Project(s) Output	MWh
		-
		-
		MWh
		-
		-

- Zero Emission Gen**
- Renewables Gen
- Nuclear Gen
- Fossil Based Gen**
- Coal Gen
- Natural Gas Gen

wer		-		Oil/Diesel Gen
			MWh	Purchased Supply
		-		Bulk Grid Purchases
		-		Coal Gen Purchases
		-		Nat Gas Purchases
				RE Purchases
				Nuclear Purchases
		-	MWh	Total

emission supply additions are assumed to be replaced by grid electricity purchases to n
nted in Tab C)

Current **New (Base System+Zero Emission New Gen-Fossil Closures-Legal**

0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%
0.0%	0.0%

		GHG Avoided (Tons):	
New Annual GHG (Tons)		Savings from ZE Addit	
	CO2	-	-
	N2O	-	-
	CH4	-	-
New	Annual CO2e (Tons)	-	-
	Lifetime CO2e (Tons)	-	-

Avoided Emissions

Cost Effectiveness		Cost Effectiveness
-	Proj \$/Ton CO2e	-
-	Proj \$/Ton CO2e	-

Avoided Emissions

When there will be no GHG reductions but only GHG avoided. Metrics based on reduction will be zero. Renewable generation values are still valid.



› emission projects)

ip only include your share of the output.

ar

n the baseline year.

urchase)

›)

urchase)

urchases)

ase)

I Purchases)

ling Results

Do not exceed 30 years

Do not exceed 30 years

Do not exceed 30 years

Do not exceed 30 years

- years

Incl. all new zero emission supply and carbon capture

Do not exceed 30 years

Estimated or Results of Power System Simulation Modeling

Cannot be Greater Than Baseline System Losses

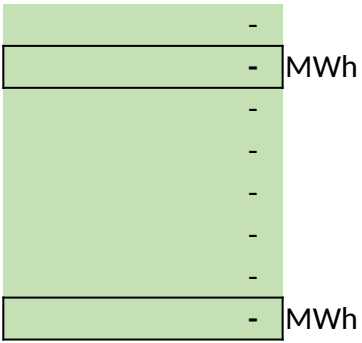
es and zero emissions capacity.

on-zero emission gen and purchases?

after phase down of non-zero emission supplies.

New System Supply Mix

-	MWh
-	
-	
-	MWh
-	
-	



meet minimum baseline service demands.

(Net Op Reductions+Purchases)

Emissions Based on Non-Baseload Emission Rates

RUS \$/Ton CO2e Reduction

RUS \$/Ton CO2e Reduction + Avoided

| be zero or undefined.

**UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)
RURAL UTILITIES SERVICE (RUS) ELECTRIC PROGRAM**

ELIGIBLE ENTITY LEGAL NAME:

Test Case: Large Generic G&T

PROJECT NAME:

Test Case: 1000 MW wind project (can be one or
down of non-zero emission supply sources

DATE:

4/3/2023

NOTES:

Space is provided below for any additional comments or feedback.

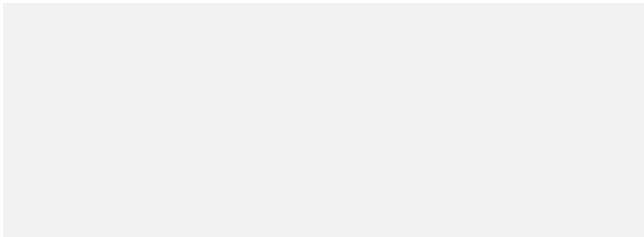
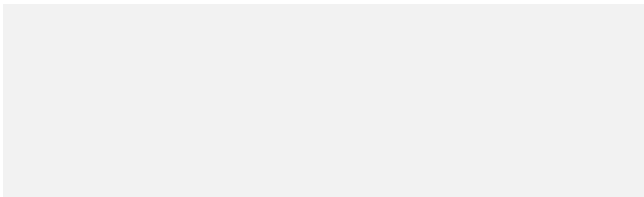
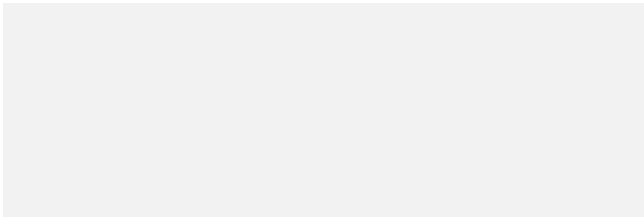
System portfolio impacts

Achieving Your Decarbonization Plan

Other details or comments



several) with partial contributions to phase



USDA Rural Utilities Service (RUS) Greenhouse Gas (GHG) Calculator for Utility-Scale R

**This calculator is to be used by applicants to the Inflation Reduction Act (IRA)
New Empowering Rural America (New ERA) - SEC. 22004. USDA ASSISTANCE FOR RUR**

Priority -- To achieve the greatest reduction in carbon dioxide, methane, and nitrous c

For Purchased Power: U.S. Electricity Grid Averages (2021)

GHG	lbs/MWh	latest eGrid	Capacity Factors
CO2	818.3	852.3	49.30%
N2O	0.009	0.01	54.40%
CH4	0.065	0.071	16.40%
CO2e		857	

100 year Greenhouse Gas Global Warming Potential (GWP) Multiplier

To calculate CO2 equivalents (CO2e)

		NREL
CO2	1	1
N2O	298	265
CH4	25	28

For Electric Generation By Fuel Type

	EIA	eGrid	eGrid	
	Heat Rate (Btu/kWh)	Emission Factor CO2/MMBtu)	(kg Emission Factor N2O/MMBtu)	(g
Coal	11,000	93.28		1.6
Nat. Gas CC	7,700	53.06		0.1
Oil	11,000	75		0.6
Nuclear	10,500	0		0
Renewables	-	0		0

Renewable Energy Projects Generating Electricity

AL ELECTRIC COOPERATIVES

oxide emissions associated with rural electric systems

Calculation Check

2021	MWh	CO2	N2O
U.S. Generation	4,120,000,000		
Coal 23%	947,600,000	2139089497600	36691072
NG 38%	1,565,600,000	1407218267840	2652126
Oil 0.5%	20,600,000	37389000000	299112
Renewables 19.5%	803,400,000	0	0
Nuclear 19%	782,800,000	0	0
	Total lbs/MWh	869.83	0.01
	874.40 Total CO2e lbs/MWh	869.83	2.87

Avoided CO2e Factor

eGrid, U.S. non-baseload output CO2e marginal emission rate, 2021

1417.3 lbs CO2e/MWh

1400 CO2

0.016 N2O

0.11 CH4

eGrid	Calculated	Calculated	Calculated
Emission Factor (g CH4/MMBtu)	Emission Factor (lbs CO2/MWh)	Emission Factor (lbs N2O/MWh)	Emission Factor (lbs CH4/MWh)
11	2257	0.039	0.266
1	899	0.002	0.017
3	1815	0.015	0.073
0	0	0	0
0	0	0	0
2021	eGrid	eGrid	eGrid
Coal	2151	0.035	0.239
Nat. Gas CC	894	0.002	0.017
Oil	1667	0.017	0.10

eGrid and Calculated Values are in close agreement.

CH4

252251120

26521264

1495560

0

0

0.07

1.70