Oregon Department of Environmental Quality
CFP Expansion 2022 Rulemaking
Proposed Simplified Calculator for Biogas to Electricity Pathways
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Background

The final draft version of the actual calculator (i.e., the MS Excel version) for the anaerobic digester of dairy and swine manure simplified calculator for biogas to electricity pathways will be posted and available for comment on April 5, 2022.

Modifications

The Clean Fuel Program is proposing the following modifications to the biomethane from anaerobic digester of dairy and swine manure simplified calculator for biogas to electricity pathways.

a. In the "avoided emissions" tab, alter the following formulas to use cell C45, which references the quantity of biogas supplied to electricity generation rather than the quantity of biomethane pipeline injected in cell C43:

> i. In cell C47, replace the allocation factor formula with C45/C40.

> ii. In cell C50, replace C49/C43 with C49/C45.

> iii. Similarly, in cell G51 of the same tab, replace G50/C43 with G50/C45

b. For the adjustment factor, in the "EF table" tab, starting from cell D89, add the following parameters and formulas to calculate the adjustment factor:

	D	E
89	Reciprocating eng. Efficiency (LHV), %	='Biogas-to-RNG'!X52*Reference!F49/'Biogas-to-RNG'!W55
90	Reciprocating eng. Efficiency (HHV), %	='Biogas-to-RNG'!X52*Reference!F49/'Biogas-to-RNG'!W54
91	Benchmark efficiency (HHV), %	50%
92	Adjustment factor	=IF(E90/E91<1, E90/E91,1)

c. The emission factors for biogas electricity production using a stationary reciprocating engine (in g/MMBtu of biogas input) are built into the "EF table" tab. If another technology is used to produce electricity from biogas, the applicant should modify cells C76 to E83 to reflect the emissions of such technology. Applicants should consult with the CFP staff for assistance in deriving appropriate emission factors for technologies other than a stationary reciprocating engine. Then, in the "EF table" tab, starting from cell E75, add the following parameters and formulas to apply the adjustment factor to the combustion emission factors for biogas electricity production using a stationary engine:

d. Finally, convert the CI result to per MJ of electricity: Several modifications in the "biogasto-RNG" tab appropriately incorporate the emissions from electricity generation and the adjustment factor from previous steps and calculate the final CI of the biogas electricity:

> i. In "Section 2. biomethane production data," replace the original contents in cell D52 with =IFERROR(SUMPRODUCT(C28:C51/SUM(C28:C51),D28:D51),0), and in cell F52 with =IFERROR(SUMPRODUCT(E28:E51/SUM(E28:E51),F28:F51),0). This ensures the weighted average biomethane content is accounted for in the calculation.

	B	C	D	E	F	G
84	**Manure to Electricity**					gCO₂e/MJ
85	**3-CAMX Mix**					
86, 87		Reciprocating engine emissions				
88						='EF Table'!E82
89				Credits	Methane avoided	= 'Avoided Emissions'!C52*'EF Table'!E92
90					CO2 diverted	='Avoided Emissions'!G52*'EF Table'!E92
91					Final electricity CI	=IF(W52=0,0,(G68+G75+G89+G90+G88)/'EF Table'!E89)
92						
93						

(Note: The header for G84 reads gCO₂e/MJ)

ii. In "Section 4. CI calculation details," modify each formula from cell F64 to cell F74 by replacing $V$55 with $W$55. This modification changes the functional unit of the CI from "per MMBtu biomethane injected into the pipeline" to "per MMBtu biogas used for electricity production."

iii. In cell G67 and cells G71:G74, replace Reference!$H$45 with Reference!$H$45*'EF Table'!E92. This modification adjusts emissions that are associated with biogas combustion and fugitive emissions.

iv. Delete original content in cells B76:G83 and cells C85:G85 because the pipeline transmission, compression, liquefaction, and transportation of CNG and LNG are not relevant in this pathway.

v. From cell B84 to cell G93, modify according to the following table. Note: All blank cells in the following table do not contain values. The applicant should delete the original content in these cells—within the simplified calculator.

	C	D	E
75	Biogas electricity production		Adjusted carbon balance using ratio in E92
76	**Stationary Reciprocating Engine**	g/MMBtu biogas input	g/MMBtu biogas input
77	VOC	62.7	=D77*$E$92
78	CO	273.5	=D78*$E$92
79	CH4	446.0	=D79*$E$92
80	N2O	0.9	=D80
81	CO2	57561.1	=D81*$E$92
82	Subtotal gCO2e/MJ	66.0	=(E77*Reference!$B$22+E78*Reference!$B$23 +E79*Reference!$B$20+E80*Reference!$B$21+E81) /Reference!$H$45

Alternate formats

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