The Greenhouse Gas Life Cycle Energy Emissions Model (GLEEM) Readme File

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This readme file describes how to use the 2025 version of GLEEM. To learn about the model, download the 2025 Technical Report on the BOEM website.

This model is in Microsoft Excel. To run the model for a particular scenario, update the following values:

- For each project: At least two cells must be updated (**Section 1**)
- For substituted fuels: Six additional cells must be updated (**Section 2**)
- Annually: Multiple cells across three tabs must be updated (**Section 3**)

NOTE: See **Section 3.2** if only certain types of fuel (motor gasoline, aviation fuel, etc.) are expected to be produced for a particular scenario.

Finally, see **Section 4** for a description of the output data.

1 Updates for Each Model Run

Two cells must be updated for each model run. In the Overview tab, complete the following:

- **C3:** Enter the expected oil production (in barrels)
- **C4:** Enter the expected natural gas production (in thousands of cubic feet)

Additionally, to include self-calculated upstream emissions, complete the following:

- **D3, E3, F3:** Enter the CO_2, CH_4, N_2O (respectively, in metric tons) to be released onsite from oil production
- **D4, E4, F4:** Enter the CO_2, CH_4, N_2O (respectively, in metric tons) to be released onsite from natural gas production

Note: BOEM does not recommend using these additional cells if onsite facilities will be processing multiple fuels.

If a user has individual years of production data, individual years of midstream and downstream emissions can be calculated under the Annualized Emissions tab. Note that this calculation is optional and has no effect on the results presented in the Overview tab.

- **Column B:** Enter the oil production (in barrels of oil)
- **Column C:** Enter the natural gas production (in thousands of cubic feet)

2 Updates for Each Model Run with Substitutions

To use GLEEM for substitutions, go to the Substitution Rates tab and enter the following data:

- **C3, C4, and C5:** Enter the percentage of oil production to be replaced by substitute sources: oil, natural gas, and coal, respectively
- **D3, D4, and D5:** Enter the percentage of natural gas production to be replaced by substitute sources: oil, natural gas, and coal, respectively

If you know the volumes, but not percentages, of the above values, edit the following cells:

- **E3, E4, and E5:** Delete the formula and enter the volume of oil production to be replaced by substitute sources: oil, natural gas, and coal, respectively
- **F3, F4, and F5:** Delete the formula and enter the volume of natural gas production to be replaced by substitute sources: oil, natural gas, and coal, respectively

NOTE: Oil should be in barrels, natural gas should be in thousands of cubic feet, and coal should be in short tons.

3 Annual Update

The fields described in this section are updated annually. These updates provide the model with the most recent consumption and emission rates for fuels. As an alternative to manually updating the files, download the most recent version of the model from the BOEM website, which includes the most recent consumption and emissions rates. See the 2025 Technical Report for information about the 'zero' midstream CO_2 and N_2O emissions for coal, and production gain only applying to oil.

3.1 Industry Data

The information on the Industry Data tab describes the U.S. energy market. Update the following cells annually (or download the latest model spreadsheet):

- **B3, B4, B5:** Midstream emissions CO_2 for oil, natural gas, coal (in millions of metric tons), respectively
- **C3, C4, C5:** Midstream emissions CH_4 for oil, natural gas, coal (in millions of metric tons), respectively
- **D3, D4, D5:** Midstream emissions N_2O for oil, natural gas, coal (in millions of metric tons), respectively
- **E3, E4, E5:** Resources not combusted for oil, natural gas, and coal, respectively
- **F3:** Production gain as a ratio
- **G3, G4, G5:** National oil refinery inputs (in thousands of barrels of oil), national natural gas systems inputs (in millions of cubic feet), and national coal production (in thousands of short tons)

Data comes from the following websites:

- Oil, natural gas, and coal facility emissions (Freedom of Information Act documents for the EPA's greenhouse gas inventory)
- Midstream processing and not combusted oil, natural gas, and coal inputs

3.2 Downstream EFs

On the Downstream EFs tab, update the following columns (rows labeled with "Average" do NOT need to be updated):

- **Column B:** National production of oil (in thousands of barrels per day), natural gas (in thousands of cubic feet), and coal (in thousands of short tons)
- **Column C:** CO_2 per gallon of oil, per thousand cubic feet, per short ton
- **Column D:** CH_4 per gallon of oil, per thousand cubic feet, per short ton
- **Column E:** N_2O per gallon of oil, per thousand cubic feet, per short ton

If any individual fuel type will not be used, zeros can be inserted for that row. NOTE: These values are used for both production and substitution.

Data comes from the following websites:

- Oil, natural gas, and coal consumption
- Emission factors

3.3 Downstream EFs and Multitype Fuels

On the Multitype Fuels tab, update the following columns (rows labeled with "Average" do NOT need to be updated):

- **Column B:** CO_2 per gallon of oil, per thousand cubic feet, per short ton
- **Column C:** CH_4 per gallon of oil, per thousand cubic feet, per short ton
- **Column D:** N_2O per gallon of oil, per thousand cubic feet, per short ton

If any individual fuel type will not be used, zeros can be inserted for that row. NOTE: These values are used for both production and substitution.

Data comes from the following websites:

- Oil, natural gas, and coal consumption
- Emission factors

4 Model Output

Model output can be found in the Overview tab. All values are provided in metric tons. If a user has entered individual years of oil and natural gas production, the annual emissions can be found in the Annualized Emissions tab.