Practical Use and Application of the Poultry Carbon Footprint Calculation Tool

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Introduction

The cumulative greenhouse gas (GHG) emissions from any human activity are commonly referred to as the carbon footprint. A report issued by the Joint Research Center (Steinfeild, Gerber, Wassenaar, Castel, & de Haan, 2006) defines the carbon footprint as a measure of the exclusive total amount of CO_2 emissions that are directly or indirectly caused by an activity or is accumulated over the life stages of a product. A carbon footprint involves not only CO_2 emissions, but also includes N_2O and CH_4 emissions, which are expressed in CO_2 equivalents (CO_2e). A CO_2e is the concentration of CO_2 that would give the same levels of radiative properties (the change in net irradiance at atmospheric boundaries between different layers of the atmosphere), as a given amount of CO_2 (World Research Institute, 2007). The CO_2e for a given substance is calculated over a specified time period and must be stated whenever a global warming potential (GWP) is stated. The GWP is a measure of how much a given mass of GHG is estimated to contribute to global warming. For example, GWP over 100 years for N_2O is 298. This means that the emission of 1 million tons of N_2O is equivalent to 298 million tons of CO_2 over 100 years. The GWP over 100 years for CH_4 is 25 (International Panel on Climate Change, 2006).

The Poultry Carbon Footprint Calculation Tool

The Poultry Carbon Footprint Calculation Tool was developed and designed specifically for poultry production farms. The tool can be used to estimate the greenhouse gas (GHG) emissions from pullet, breeder, and broiler grow-out farms. The GHGs that are assessed are carbon dioxide, nitrous oxide, and methane—the gases of major concern in agriculture. The user-friendly calculation tool is an Excel spreadsheet into which the user will enter farm data to calculate a poultry production farm's annual carbon footprint.

The tool can be downloaded from https://poultry.caes.uga.edu/content/dam/caes-subsite/poultry/documents/GHG-Calc-Tool.xlsm. In order for the file to work correctly, please be sure to enable macros.

Introduction Page

The spreadsheet has an introductory page or tab (Figure 1), which informs the user of the capability and the uses of it. It provides specific directions on how to enter the information into the spreadsheet. This page also gives the growers options that can be used to reduce their energy use and subsequently to reduce their carbon footprint.
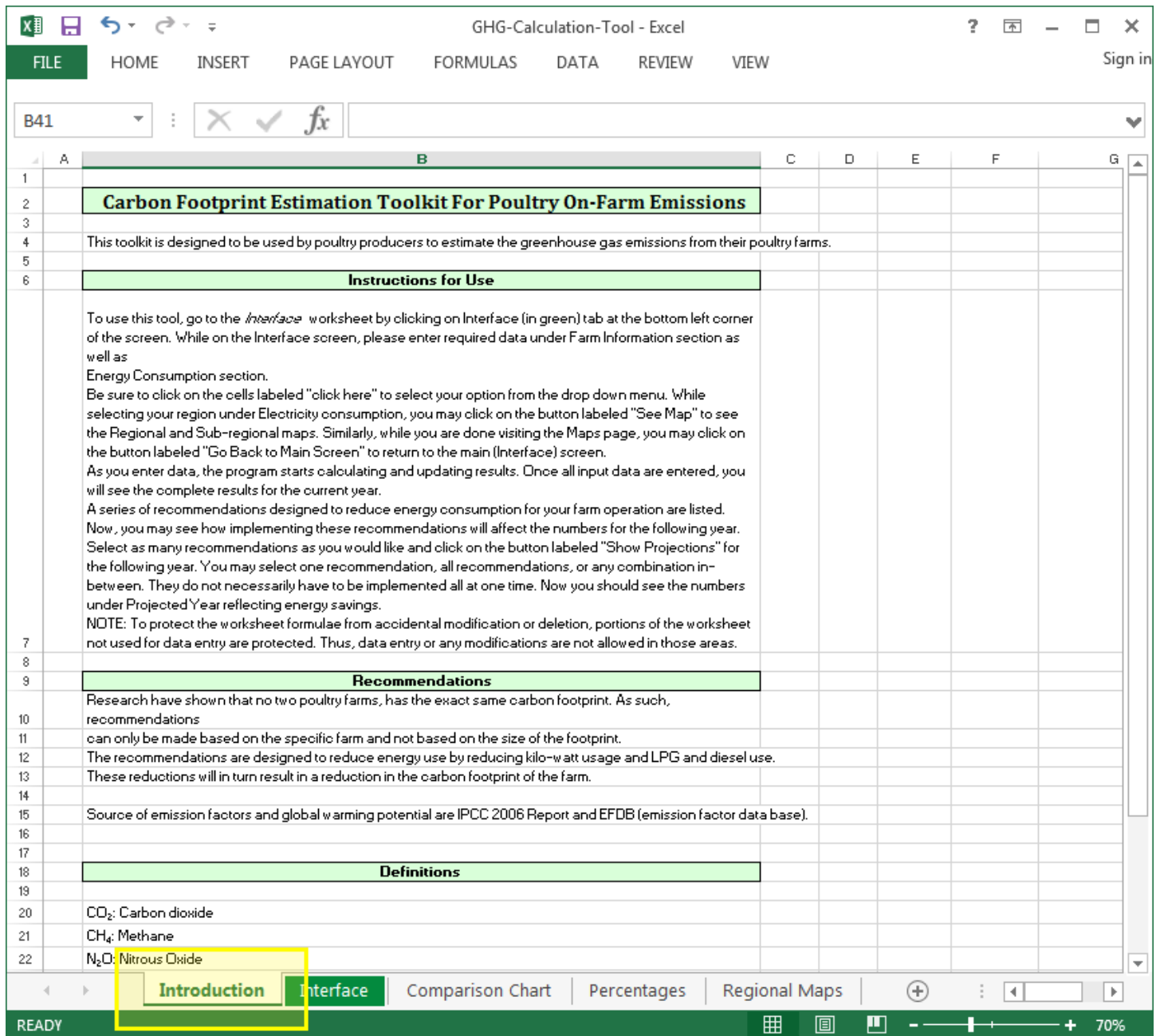

Figure 1. The introductory page can be viewed by selecting the "Introduction" tab on the bottom left of the spreadsheet.

Interface Page

Farm Information and Energy Consumption

The "Interface" tab is the only page where the user can enter data into the tool. The user will need to select from the first drop-down box (Figure 2) the type of poultry (broiler, pullet, or breeder) they have. Based on the type of bird, appropriate boxes for that operation will be available for the user to input data. This information will determine the non-mechanical emissions. The non-mechanical emissions are those GHG emissions that occur from manure management and will depend on the type of poultry, the number of birds/flocks grown per year, and the type of manure management system that is used on the farm.

The user will next enter energy consumption information. Users have the options of entering LP gas, diesel, and/or natural gas. This will determine the mechanical emissions from the farm. These emissions occur from heating, incineration, diesel for tractors, generators, and other equipment on the farm. Users will also need to enter the amount of electricity used in kilowatt hours. Electricity is used for ventilation, lighting, feed motors, and water pumps, as well as other electrical equipment for daily bird management and house maintenance. The electricity use will be reflected in the "off-farm" source in the inventory.

After entering electricity usage, the user will select from another drop-down box the region of the United States where the farm is located (Figure 2). The region is based on the electricity grid from which the user receives service. The tool recognizes that different parts of the country generate electricity from a different mix of sources (nuclear, coal, hydroelectric, etc.) This is an important feature that enables users from different parts of the United States to use the tool. Each region has a different emission factor, so it is important that the user select the
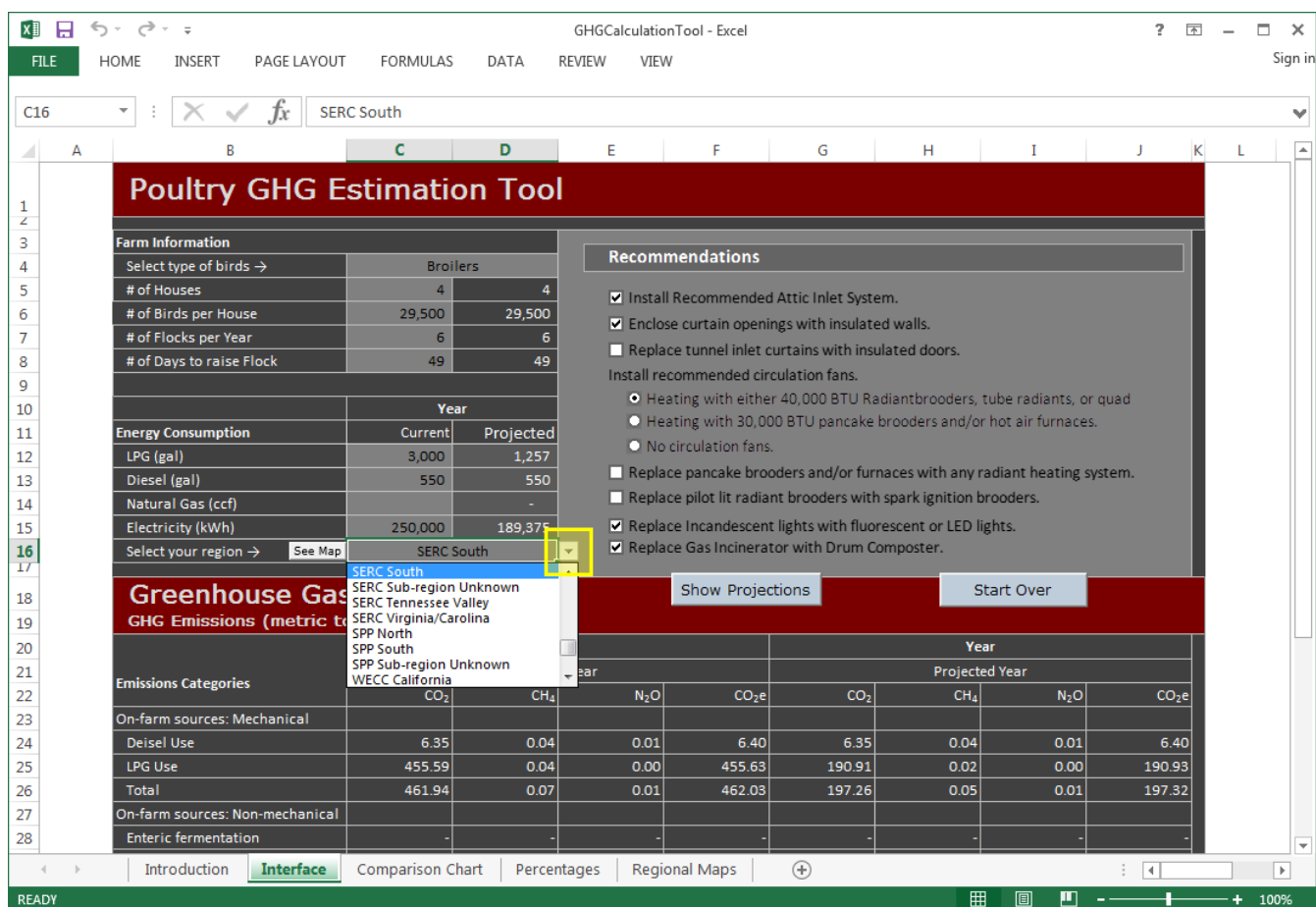

Figure 2. The data input section of the "Interface" tab. The drop-down box for selecting the user's region is indicated.

region of the country where the poultry operation is located. If users are unsure of the region they are in, they should click the "See Map" button (Figure 3a). This takes users to the "Regional Maps" page (Figure 3b), which allows them to determine which region they need to select. They can also select the "Regional Maps" tab at the bottom of the spreadsheet, which will also take them to the map.
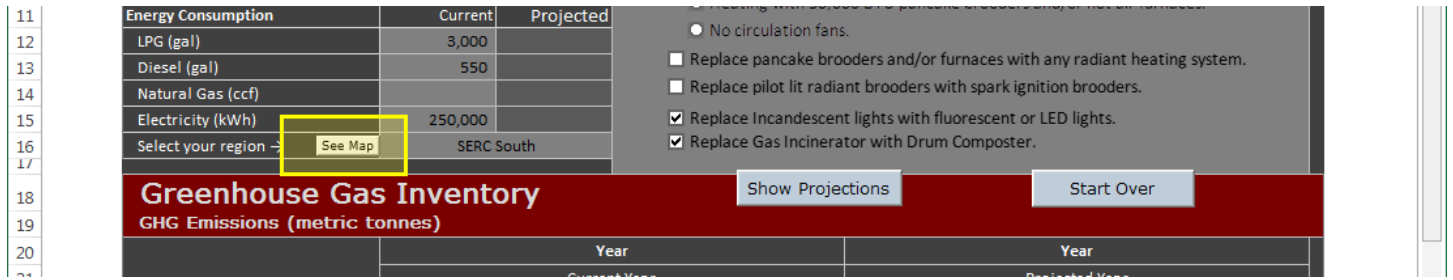

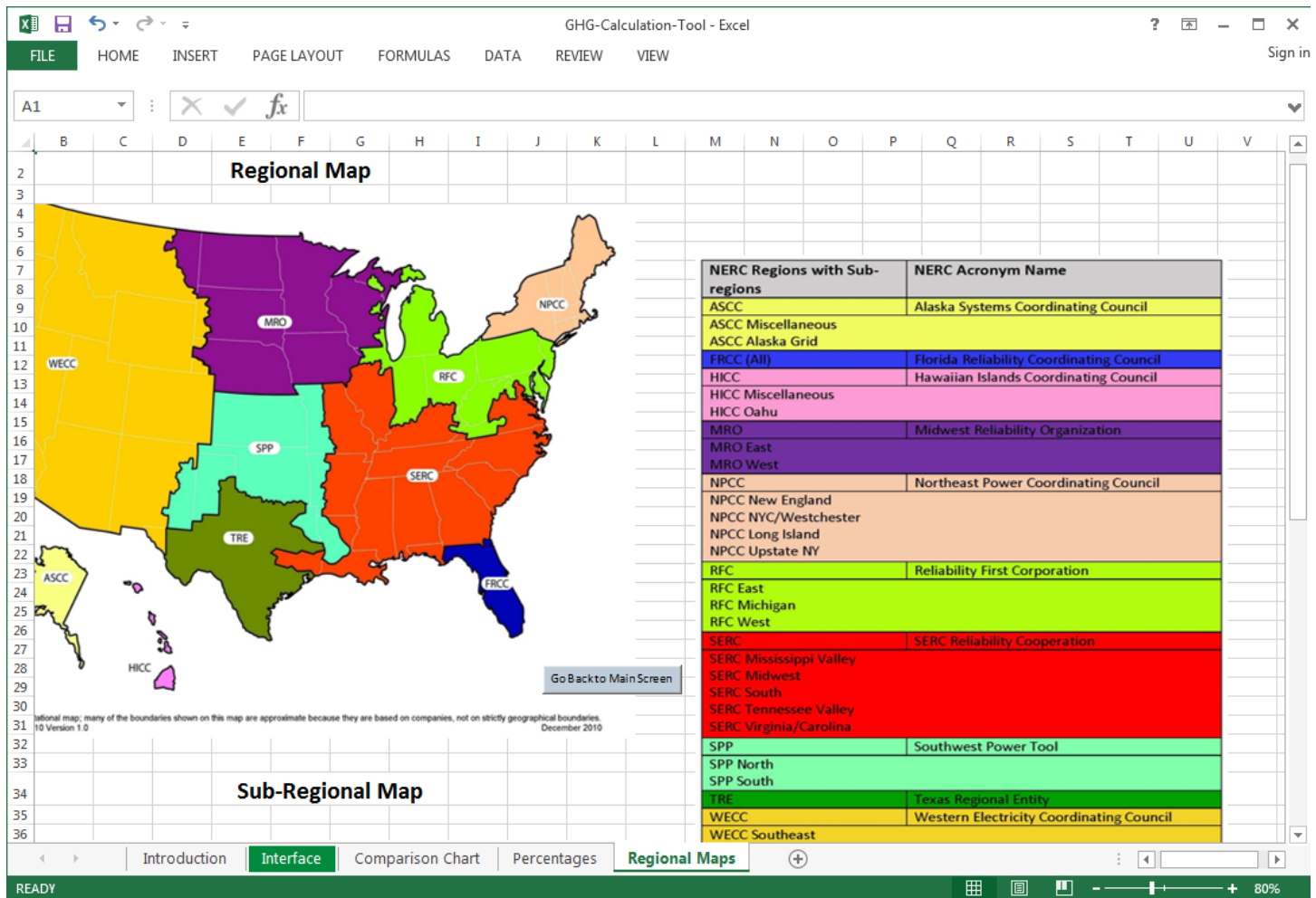**Figure 3a.** The "See Map" button is indicated.

Figure 3b. Use the "Regional Maps" tab to determine the region to input under the energy consumption section of the "Interface" page.
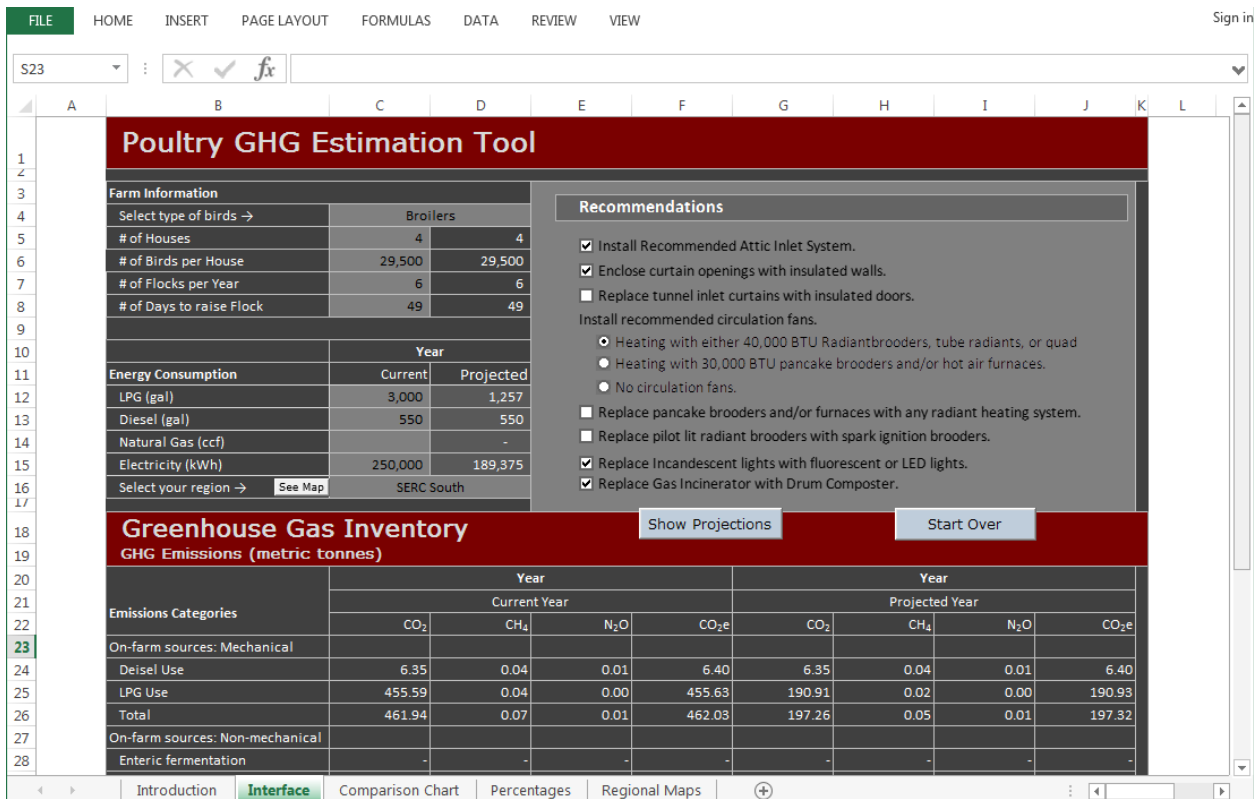
Recommendations

The calculation tool also allows the user to choose house adjustments or renovations (Figure 4a) that will result in reductions in energy use and GHGs. This can be done by selecting recommendation options to reduce energy use in the "Interface" tab. The tool will show the user what the emissions would be if these adjustments were made on the farm. The recommendations selected will affect the electricity, LPG, and/or natural gas use projections. Therefore, changes in the GHG emissions will be reflected in the mechanical and off-farm emissions inventory.
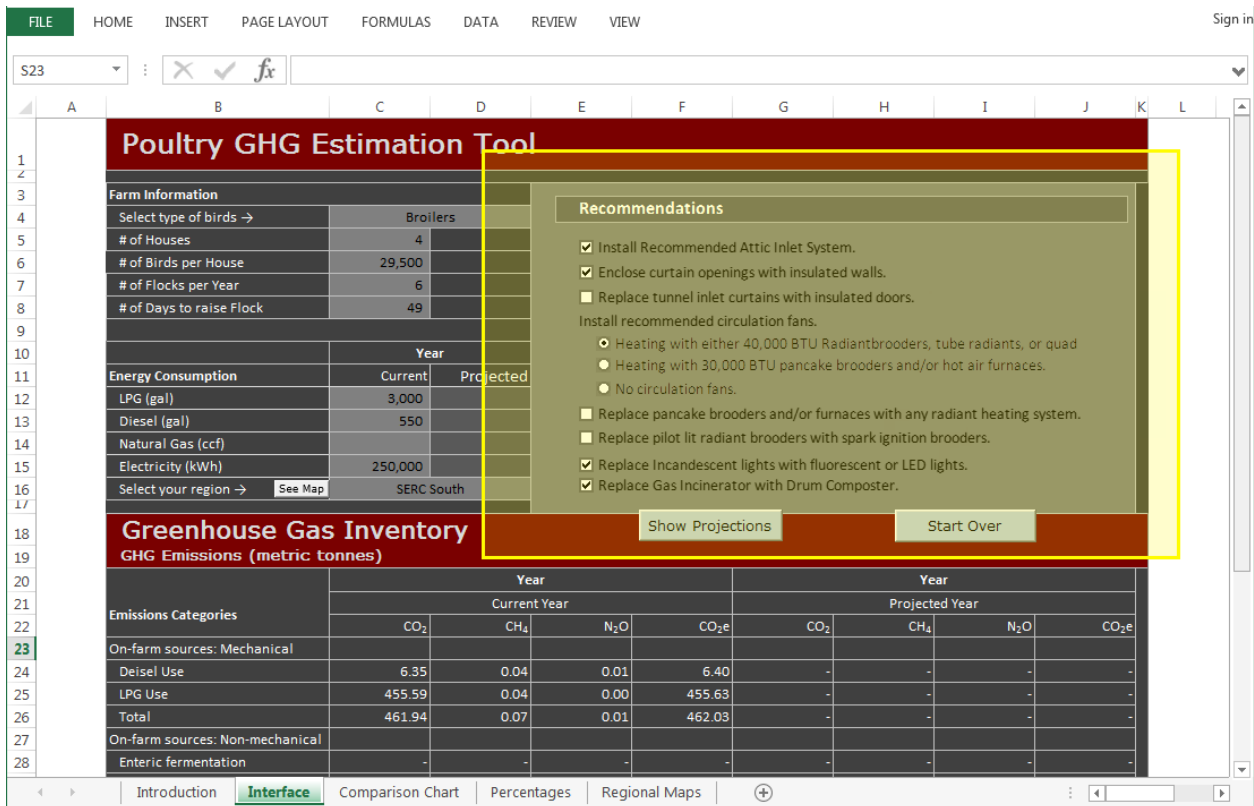
Figure 4a. Recommendations can be selected to see how emissions would be reduced.

After the user selects options from the "Recommendations" section, he or she should click the "Show Projections" button. The projected year fields of the "GHG Inventory" section will be populated with the estimated emissions (Figure 4b).

Figure 4b. The projected fields are calculated based on the selected recommendations.

Greenhouse Gas Inventory

The "GHG Inventory" section (Figure 5) on the "Interface" page shows users the sources of the emissions and also the amount of each GHG emitted. The inventory separates the emissions based on their source (mechanical, non-mechanical, and electricity use) and also on-farm and off-farm sources. It gives the total of each source and the total farm emissions. The inventory is divided into two sections, "Current Year" (the actual farm emissions) and "Projected Year" (the emissions based on the energy reduction options selected). All the emissions are represented as metric tonnes CO_2e. This inventory can be printed by selecting "Print" under the Excel file options.
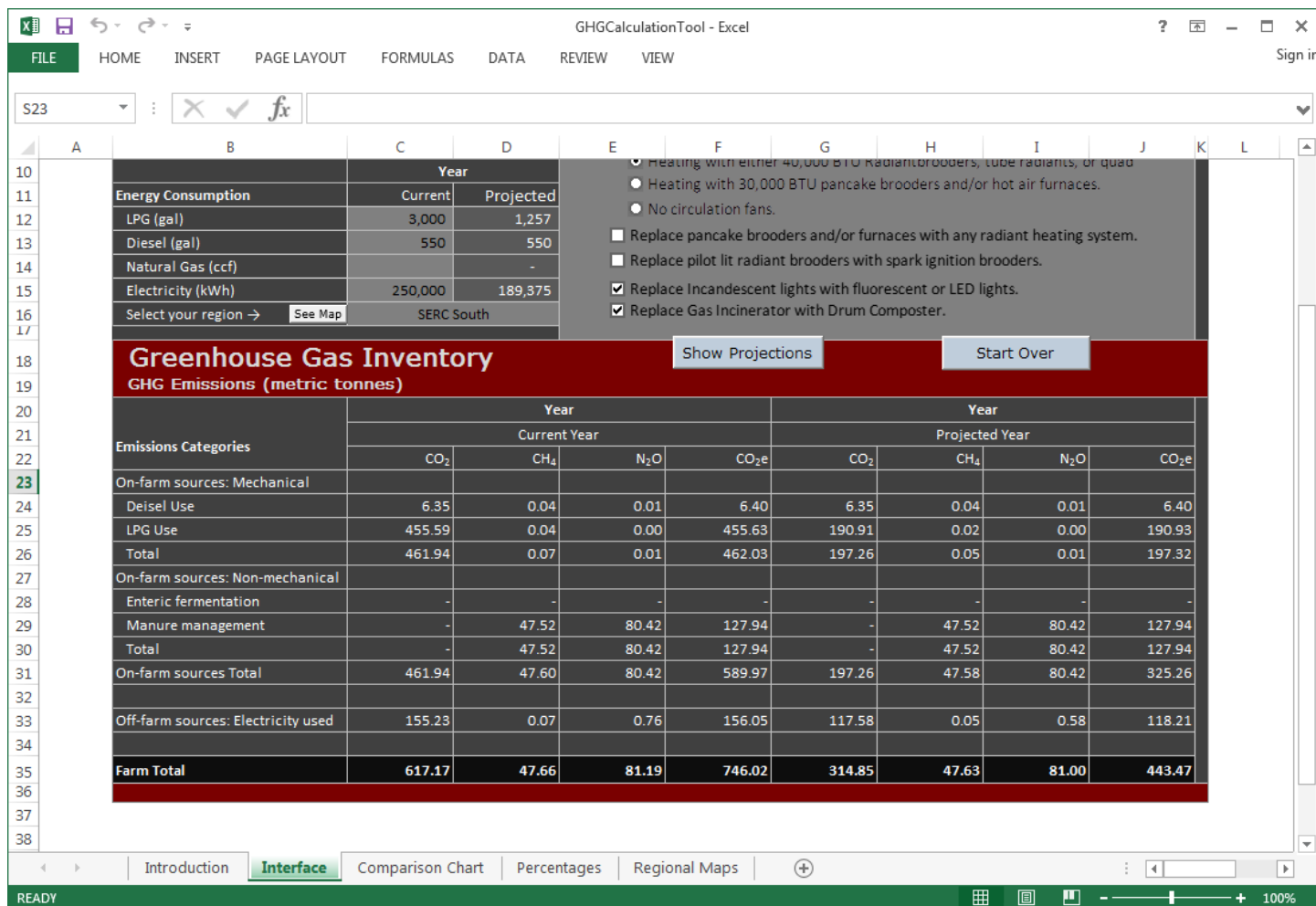

Figure 5. The Greenhouse Gas Inventory on the Interface page shows current and projected emissions.

Comparison and Percentage Charts

After the GHG inventory is calculated, the user will be able to view the comparison chart and the percentage chart in their respective tabs. The "Comparison Chart" page (Figure 6) will compare the GHG emissions from the current year and that of the projected year after the recommended changes have been made. The "Percentages" page (Figure 7) shows the percent difference after the recommendations are made. These charts can be printed for the users' record.
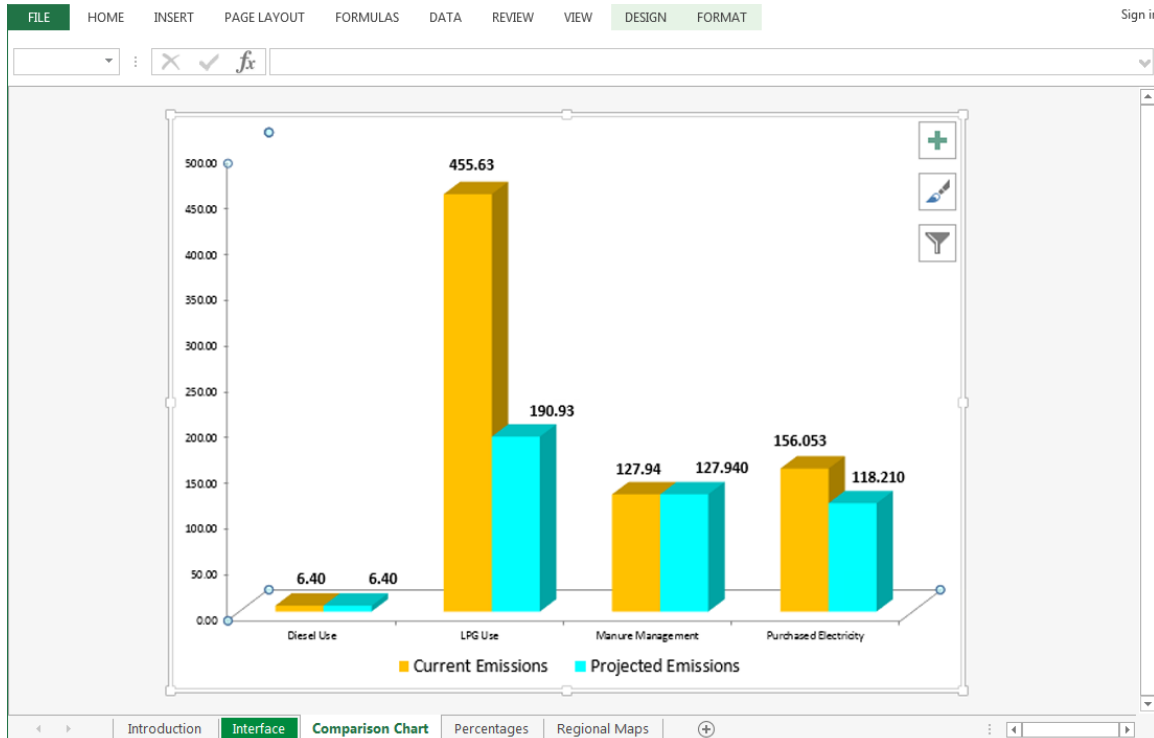
Figure 6. The "Comparison Chart" shows the differences in emissions from the actual data ("Current Emissions") and the emissions if the recommendations were made ("Projected Emissions").

Figure 7. The "Percentages" page shows the percent difference after the recommendations are made.

Applications

- This tool allows users to track their emissions from year to year in their operations.
- The "Recommendations" section of the tool allows the user to see where adjustments can be made on the farm to reduce emissions.
- The "Recommendations" section of the tool allows the user to reduce fuel costs if the recommendations are applied.
- The "GHG Inventory" section allows users to compare their current emissions per year with the projected emissions.
- The "GHG Inventory" section allows users to keep records of their year-to-year emissions, which they can use to track changes.

References

Intergovernmental Panel on Climate Change (IPCC), Task Force on National Greenhouse Gas Inventories (TFI), Eggleston H.S., Buendia L., Miwa K., Ngara T., & Tanabe K. (Eds.). (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories.* Japan: Institute for Global Environmental Strategies.

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