

Testing Results of the GBEP Methodological Framework from El Salvador and Dominican Republic



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BEET



- BEET is a **reusable decision support tool** to collectively evaluate the sustainability and country-level impacts of bioenergy policies and strategies
 - From E2 to E100
 - From B2 and up
- Key characteristics:
 - Addresses **energy security, economic, agricultural and environmental impacts** in quantitative measures
 - User friendly; Currently in Spanish and English
 - Allows analysis to be done by users on a **quick turnaround basis**
- Enables analysis of **economies of scale, financial incentives and next generation** biofuel technologies

BEET Initiative: An Integrated Step towards Full Cost-Benefit Analysis of Energy Policy

BEET

- National/Energy Security (gallons/yr)
 - Oil Imports
 - Domestic Biofuel Production
- Economic
 - GDP (Billions \$)
 - Balance of Trade (Billions \$)
 - Increases in Employment (FTE)
 - Reduction in Poverty (Household Equivalent)
- Environmental and Agricultural
 - Food Production (hectares)
 - Greenhouse Gas Emissions (tons CO₂)

Figure: BEET Country Goal Impacts

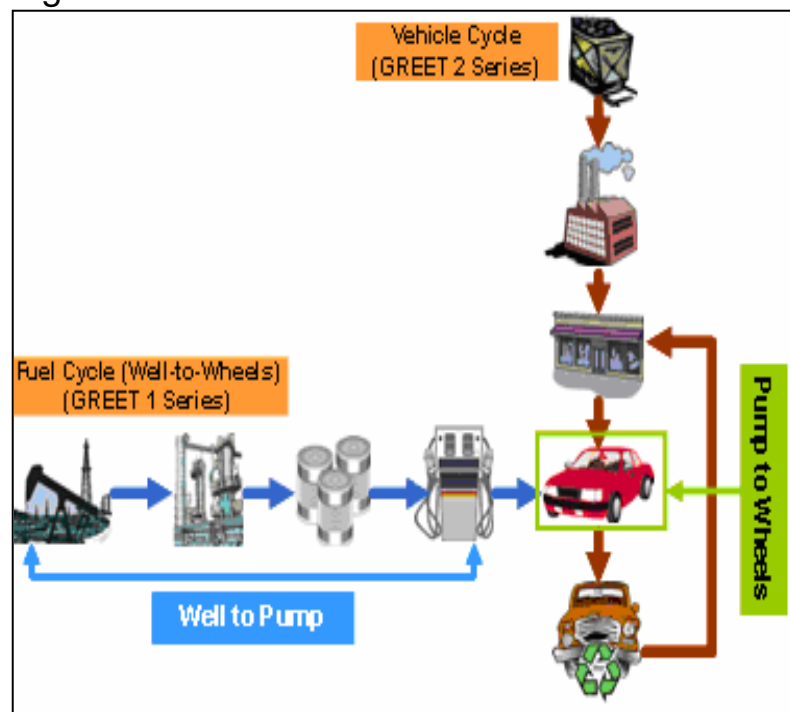
Bio Energy Evaluation Tool - Ethanol; Results Screen (Tabular)

| | Base Case Scenario Time 0 | 1 | 2 |
|--|---------------------------|-------------|-------------|
| National/Energy Security | | | |
| Gasoline Imports (gallons/year) | 113,343,972 | 113,343,972 | 102,769,... |
| Crude Oil Imports (gallons/year) | 298,176,446 | 298,176,446 | 298,176,... |
| Domestic Ethanol Production (gallons/year) | - | - | 16,083,... |
| Economic | | | |
| Gross Domestic Product (billion \$) | 20.37 | 20.48 | 20 |
| Balance of Trade (billion \$) | (4.70) | (4.70) | (4 |
| Imports (billion \$) | 13.60 | 13.60 | 13 |
| Exports (billion \$) | 7.16 | 7.16 | 7 |
| Increase in Jobs (FTE) | - | - | 5; |
| Reduction in Poverty (Household Equivalents) | - | - | 5; |
| Environmental and Agricultural | | | |
| Total Land for Ethanol Production (hectares) | - | - | 11, |
| Total Greenhouse Gas Emissions (tons CO ₂) | 1,947,580 | 1,947,580 | 1,829, |
| Other Impact Factors | | | |
| Investment in New Ethanol Production and Storage Facilities (\$) | - | 91,493,998 | |
| Investment in Ethanol-Related Infrastructure, Post-Production | - | 14,580,451 | (3,180, |
| New Ethanol Production Capacity (gallons/year) | - | - | 36,673, |
| Annual Cost of Imported Ethanol (\$) | - | - | |
| Annual Cost of Domestic Ethanol Production (\$) | - | - | 30,656, |

Argonne GREET Model

- Argonne National Lab has developed a **full life-cycle model** called GREET
- GREET addresses Greenhouse gases, Regulated Emissions, and Energy use in Transportation
- BEET uses data from GREET to help assess GHG emission impacts related to biofuel policy
- **How Does GREET Work?**
 - GREET allows analysts to evaluate various vehicle and fuel combinations
 - For a given vehicle and fuel system, GREET separately calculates the following:
 - Consumption of total energy (energy in non-renewable and renewable sources), fossil fuels, petroleum, coal and natural gas.
 - Emissions of CO₂-equivalent greenhouse gases - primarily carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).

Figure: GREET Model Pictorial



BEET uses GREET

- **BEET uses lifecycle GHG emission factors from GREET to assess country-wide impacts of alternative biofuel policies and strategies**
- **BEET calculates baseline GHG emissions and compares those with ethanol blending scenarios using the following GREET metrics:**
 - Fuel Economy
 - **Well-to-Wheel GHG Emission Factors** (gCO₂e/gallon for gasoline and E10)
 - Energy Content (for gasoline and ethanol)
- **Examples of GHG Emissions Analysis Results:**
 - Based on GREET inputs, BEET estimated the annual reduction in GHG emissions due to enacting an E10 policy in **El Salvador** (~82,000 tons CO₂e) and the **Dominican Republic** (~170,000 tons CO₂e) – about a **5% decrease** in both cases
- **BEET can readily incorporate updates and revisions in GHG emissions analysis from GREET (or from other sources)**

The key inputs to the GHG analysis in BEET come from the GREET version 1.8b. The GREET methodology requires further investigation to answer some of the questions posed by the *GBEP GHG Methodological Framework*

Step 01: GHGs Covered

- CO₂
- CH₄
- N₂O

Global Warming Potential not assessed in BEET

Step 02: Source of Biomass

- Non-waste

Identify Feedstock: Sugarcane

Step 3: Land Use Change

Emissions from land use change was not covered for sugarcane in GREET version 1.8b which was the version available and used when the studies in El Salvador and Dominica Republic were performed

Step 4: Biomass Feedstocks Production

Data not available

Step 5: Transport of Biomass

- Biomass is transported from farm/plantation/forest to processing plants (Yes)
- Biomass is transported by truck only in the BEET analysis for El Salvador and Dominican Republic
- Transport from production site to use/processing plant is dedicated to this purpose (Yes)

Step 6: Processing into Fuel

- The biomass requires processing to produce fuels (Yes)

Step 7: By-products and Co-products

- By products from the biomass are accounted for (Yes)
- Explain the definition by Co-products: Molasses

Step 8: Transport Fuel

- Fuel is transported from processing plant to use site? (Yes)
- Fuel is transported in a different commodity price? (No)
- There is a multi-stage transport chain? (No)
- Transport from the processing plant to the use site is dedicated to this purpose? (Yes)

Step 9: Fuel Use

Transport Use:

- Miles (km) per energy unit are addressed? (Yes)
- Vehicle efficiency was provided by GREET v1.8b. Energy content assumptions also came from GREET and were used derive metrics similar to (distance/energy unit)
- GREET v1.8b includes GHG emissions estimates associated with combustion sources (conventional-spark ignition vehicles)

Step 10: Comparison with Replaced Fuel

- An LCA is performed on the replaced fuel(s)/ energy production systems? (Yes)

THANK YOU!