EISA RFS2 Life Cycle Analysis Overview

Workshop Overview

- Requirements of EISA
- General overview of lifecycle methodological process and results
- Individual presentations with more detail on process and methodology
- Stakeholder presentations providing technical feedback

New Standards

- **Four Separate Standards**
  - **Cellulosic Biofuel: 16 billion gallons by 2022**
    - Renewable fuel produced from cellulose, hemicellulose, or lignin
    - E.g., cellulosic ethanol, BTL diesel, green gasoline, etc.
    - Must meet a 60% lifecycle GHG threshold
  - **Biomass-Based Diesel: 1 billion gallons by 2012**
    - E.g., Biodiesel, BTL diesel, "renewable diesel" if fats and oils not co-processed with petroleum
    - Must meet a 50% lifecycle GHG threshold
  - **Advanced Biofuel: 21 billion gallons by 2022**
    - Includes cellulosic biofuels and biomass-based diesel plus an additional 4 billion gal
    - Essentially anything but corn starch ethanol
    - Must meet a 50% lifecycle GHG threshold
  - **Total Renewable Fuel: 36 billion gallons by 2022**
    - Includes up to 15 billion gallons conventional biofuel (ethanol derived from corn starch or any other qualifying renewable fuel)
    - Must meet 20% lifecycle GHG threshold
    - Only applies to new fuel production capacity (more on this later)

- **EISA language permits EPA to adjust the lifecycle GHG thresholds by as much as 10% -- (60% to 50%; 50% to 40%; 20% to 10%)**
  - **Based on the market availability of fuels that could count as advanced biofuel, we are proposing that the GHG threshold for advanced biofuel be adjusted to 44%%**

Lifecycle GHG Emissions

- **Lifecycle GHG analysis is integral to the new RFS2 Standards**
  - Without a determination of whether a fuel does or does not comply with the thresholds, the program cannot be implemented

"**The term 'lifecycle greenhouse gas emissions' means** the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the Administrator, related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential."

Lifecycle GHG Thresholds

- **GHG thresholds are defined as the % reduction in lifecycle GHGs for a renewable fuel in comparison to the 2005 baseline gasoline or diesel that it displaces**
  - Lifecycle GHG estimates are only used to categorize renewable fuels into the four standards, not to value them

- **We have conducted lifecycle analysis for a variety of renewable fuel pathways**
  - Additional analysis for final rule is expected to expand the list of pathways and revise input assumptions based on new information
  - Also proposing a "default" mechanism that would allow some renewable fuels to temporarily generate RINs even if we did not explicitly analyze their lifecycle GHG impacts

- **While each renewable fuel pathway has a unique lifecycle GHG emissions impact in grams/mmBtu, for RFS2 regulatory purposes these lifecycle emissions are used only to compare each pathway to the applicable threshold and assign it to one of the four renewable fuel categories**

Methodology

- EISA definition requires the use of a number of models and tools
  - Including direct and indirect impacts such as land use change requires analysis of markets
    - Typical life cycle analysis tools are based on process modeling
    - To capture market impacts need to use economic models
    - Captures opportunity cost of different uses of crops / land
- Scenario Comparison: Run models with different volume scenarios to isolate the impact of specific fuel
  - Consider change between baseline projected fuel volume in 2022 (i.e., without RFS2) and projected RFS2 mandated volume
  - Not considering changes from one year to next but difference in given year with different biofuel volumes
  - Held volumes of other fuels constant at RFS2 mandated levels, hold other outside impacts constant across scenarios (e.g., population growth) so isolating impacts of biofuels
- For areas of uncertainty, we have tested our primary approach and key assumptions with sensitivity analyses and different methods

Steps for Determining Lifecycle GHG Emissions

Steps in Lifecycle Analysis

Step 1 — Determine Agricultural Sector and Land Use Change Impacts

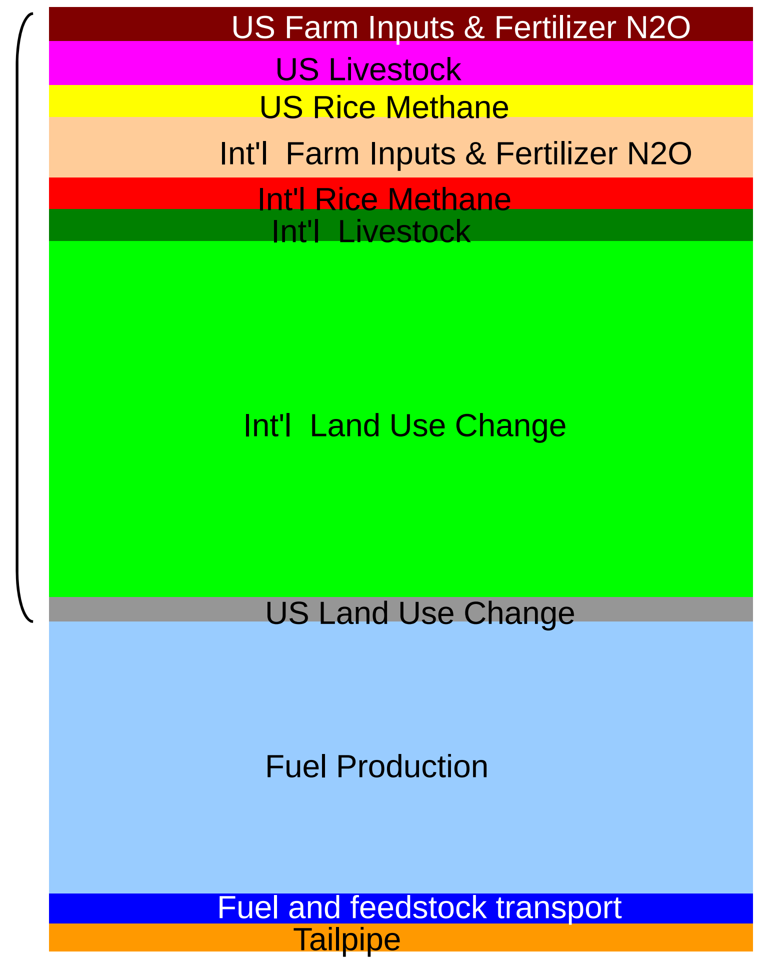
Step 2 — Determine GHGs from Agricultural Sector and Land Use Change Impacts

Step 3 — Determine GHGs from Processing

Step 4 — Determine GHGs from Fuel and Feedstock Transport

Step 5 — Compare Emissions to Petroleum Baseline

Lifecycle GHG Emissions



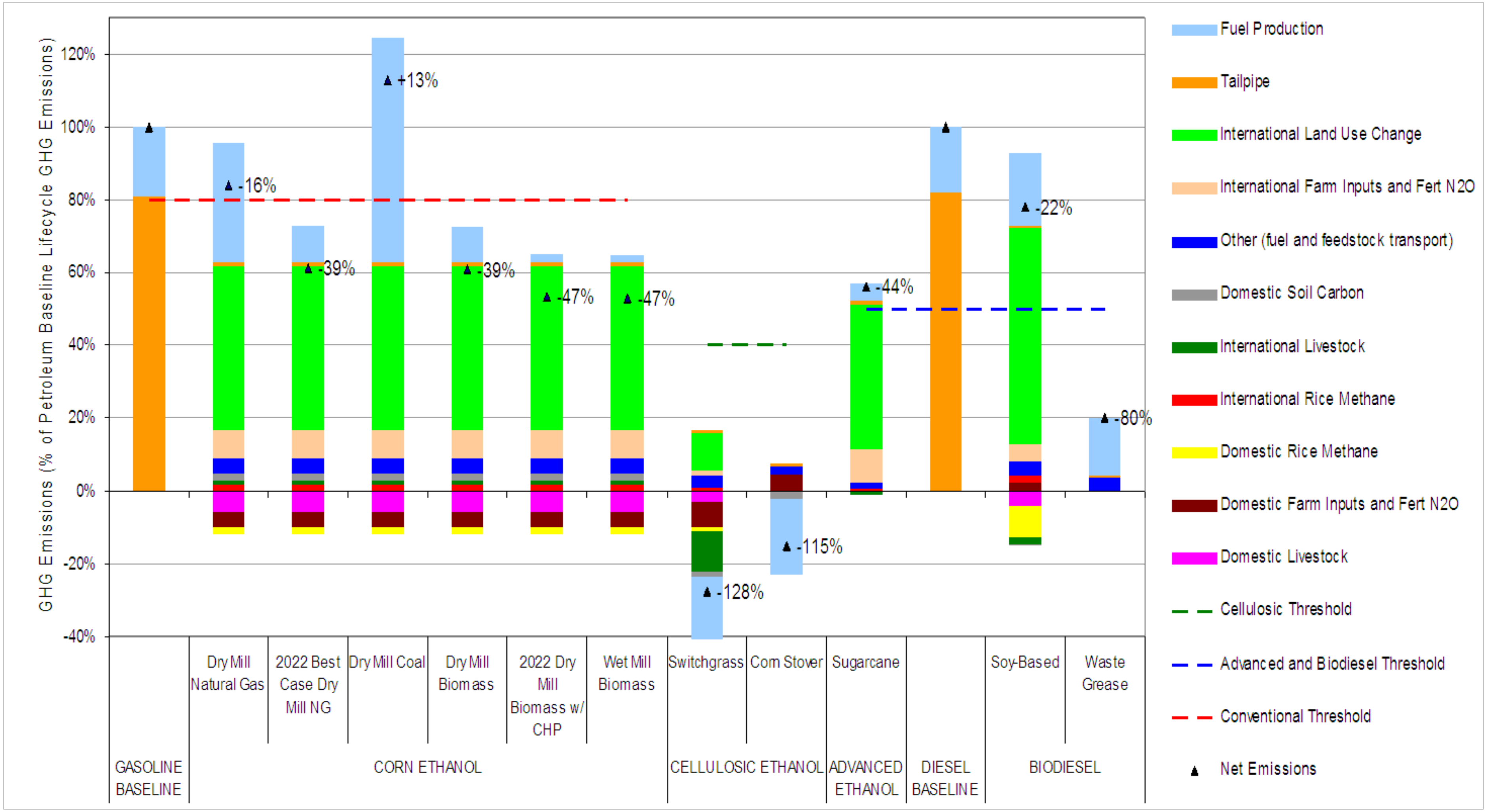
Key Models and Data Sources

- Agricultural sector models (FASOM, FAPRI)
  - EPA selected the FASOM model for this analysis for several reasons
    - Peer reviewed through use in numerous journal articles
    - FASOM accounts for changes in CO_2, methane, and N_2O from most agricultural activities and tracks carbon sequestration and carbon losses over time
    - FASOM captures the impacts of all crop production, not just biofuel feedstock. Thus, as compared to some earlier assessments of lifecycle emissions, using FASOM allows us to determine secondary agricultural sector impacts, such as crop shifting and reduced demand due to higher prices.
  - EPA selected FAPRI for several reasons
    - Peer reviewed through use in numerous journal articles and annual baseline process
    - These models capture the biological, technical, and economic relationships among key variables within a particular commodity and across commodities.
    - The FAPRI models have been previously employed to examine the impacts of World Trade Organization proposals, changes in the European Union's Common Agricultural Policy, analyze farm bill proposals since 1984, and evaluate the impact of biofuel development in the United States
    - The FAPRI models have been used by the USDA Office of Chief Economist, Congress, and the World Bank to examine agricultural impacts from government policy changes, market developments, and land use shifts
- Land use changes (FASOM, FAPRI, MODIS)
  - MODIS satellite data is the only consistent set of worldwide satellite data on land use change available
  - MODIS data has been validated by NASA
- Emission factors (GREET, Winrock)
  - Winrock data based on IPCC guidance using the latest available information to determine carbon content of different types of lands at regional levels by country
  - GREET is widely used and accepted model for direct emissions from transportation fuels and lifecycle GHG emission factors

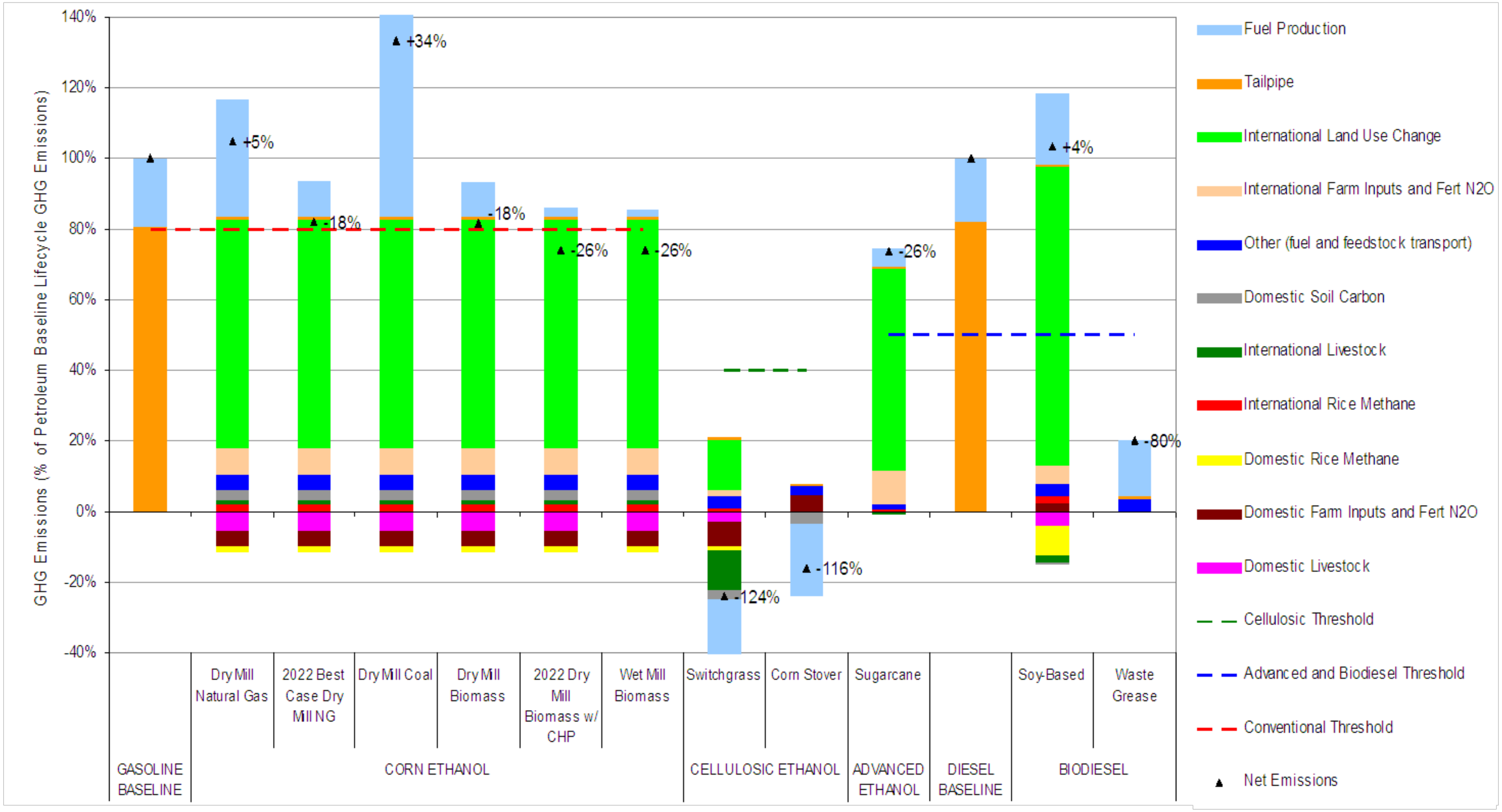
Presentation of LCA Results in the Proposal

- **Thorough description of our new methodology and results**
- **Acknowledges uncertainty, particularly for land-use change impacts**
- **Presents the results, along with various sensitivity runs**
  - Corn ethanol assessments for different volumes, different years
  - Different assumptions for land use impacts
    - Bracketing pasture replacement (zero to 100%)
    - Type of land converted (assume 100% grassland)
  - Impact of foregone sequestration over time
- **Likewise we present several options for valuing the impacts over time**

Biofuel Lifecycle GHG Results: *Different Pathways with 2% Discount Rate – 100 years* *(2022 Values)*



Biofuel Lifecycle GHG Results: *Different Pathways with 0% Discount Rate – 30 years* ***(2022 Values)***



Key Areas Where EPA is Seeking Feedback

- EPA has described as transparently as possible all the models, inputs, and data used in the lifecycle analysis and is seeking comment on all of it.
- EPA has provided access to the actual models used as well as to the input and output files.
- Through the analysis we have identified areas of key importance that we will discuss in more detail and are specifically seeking comment on including:
  - Model inputs (e.g., crop yields, fertilizer, energy use, co-products)
  - Use of historic satellite data to determine types of land converted
  - Choice of models used (FASOM/FAPRI or GTAP model approach)
  - Treatment of land use policies in other countries
  - Treatment of emissions over time
  - Threshold adjustments

Formal Peer Review

- **Conducting a formal peer review (between proposal and final rule) of key elements of our lifecycle analysis:**
  1. Land use modeling (use of satellite data/ land conversion GHG emission factors)
  2. Our estimates of GHG emissions from foreign crop production
  3. Methods to account for the variable timing of GHG emissions
  4. How the models we've relied upon are used together to provide overall lifecycle estimates

- **We are following EPA peer review guidelines (developed by an internal advisory group in order to ensure consistent Agency-wide implementation of peer review).**
  - EPA's guidelines also incorporate OMB's government-wide peer review bulletin

- **In accordance with this guidance, we are using an independent, third-party contractor to conduct an external peer review**
  - Contractor identifies list of expert reviewers, checking for possible conflict of interest
  - Also conducts meetings, teleconferences, etc, in order to clarify technical components of the product and develops the peer review record

- **The peer review record will be available to the public, including:**
  - Materials provided to the peer reviewers
  - List of names and affiliations of the peer reviewers
  - Summary of comments, as well as comments attributable to individual reviewers

- **Timeframe**
  - The plan is for the peer reviews to be completed by the end of June; experts have at least one month to complete their review

Workshop Agenda

Steps in Lifecycle Analysis		Time	Topic
Step 1	Determine Agricultural Sector Impacts and Land Use Change	Day 1 1:30 – 5:00	Agricultural Sector Modeling Amount of Land Use Change
Step 2	Determine GHGs from Agricultural Sector Impacts and Land Use Change	Day 2 8:30 – 11:30	Types of Land Use Change LUC GHG emissions Timing & Discount Rate
Step 3	Determine GHGs from Processing	Day 2 11:30 -- 12:30	Biofuel Processing
Step 4	Determine GHGs from Fuel and Feedstock Transport	Day 2 11:30 – 12:30	Transport Emissions
Step 5	Compare Emissions to Petroleum Baseline	Day 2 11:30 – 12:30	Petroleum Baseline

Lifecycle GHG Emissions