Review of EPA/OTAQ Biofuel LCA Work for the RFS Program

CAAFI Environment Team Workshop

January 27, 2014

RFS LCA Modeling Approach

- The EISA definitions required the use of a number of models and tools (we developed a hybrid attributional / consequential approach)
  - Including direct and indirect impacts such as land use change required a consequential approach and analysis of markets (we focused on agricultural sector indirect impacts)
  - We also included our own process and emissions attributional modeling as part of the rulemaking for biofuels and the petroleum baseline
- Our approach required that we consider how commodity markets are affected by increasing demand for biofuels
- We did this using a scenario approach in which we ran models with different volume scenarios to isolate the impact of a specific fuel
  - We measured the impact of the delta between baseline projected fuel volume in 2022 (i.e., without RFS2) and projected RFS mandated volume
  - Held volumes of other fuels constant at RFS mandated levels
- Indirect impact results were based on a comparison of two modeled scenario results, not actual measurements.

Table 2.3-1. Fuel Volume Scenarios Considered in This Analysis (Billions of Gallons)

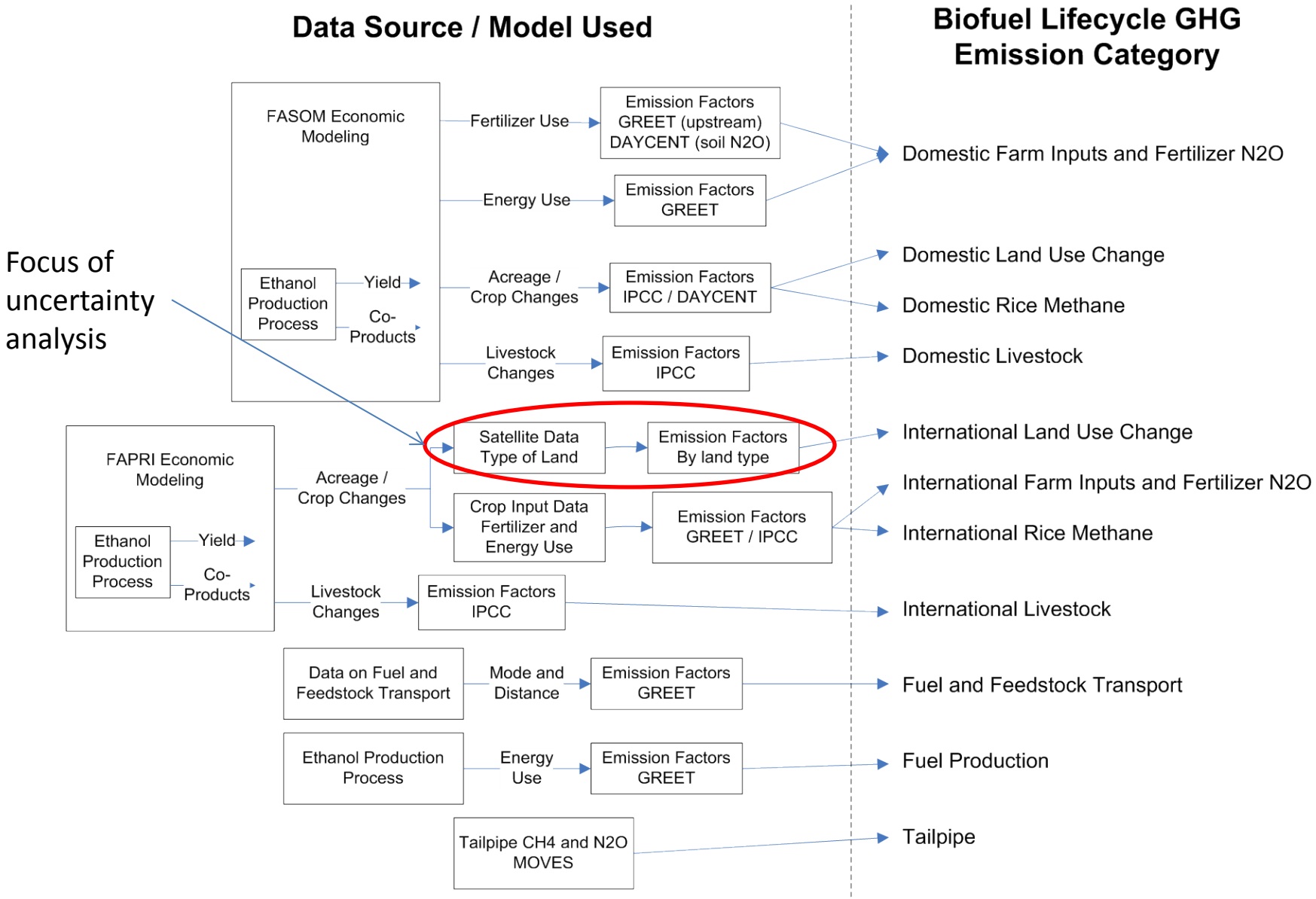
Biofuel	Reference Case – Low Volume	Control Case – High Volume	Change
Corn Ethanol	12.3	15.0	2.7
Switchgrass Cellulosic Ethanol	0	7.9	7.9
Corn Residue Cellulosic Ethanol	0	4.9	4.9
Imported Sugarcane Ethanol	0.6	2.2	1.6
Soybean Oil Biodiesel	0.1	0.6	0.5

RFS and Jet Fuel

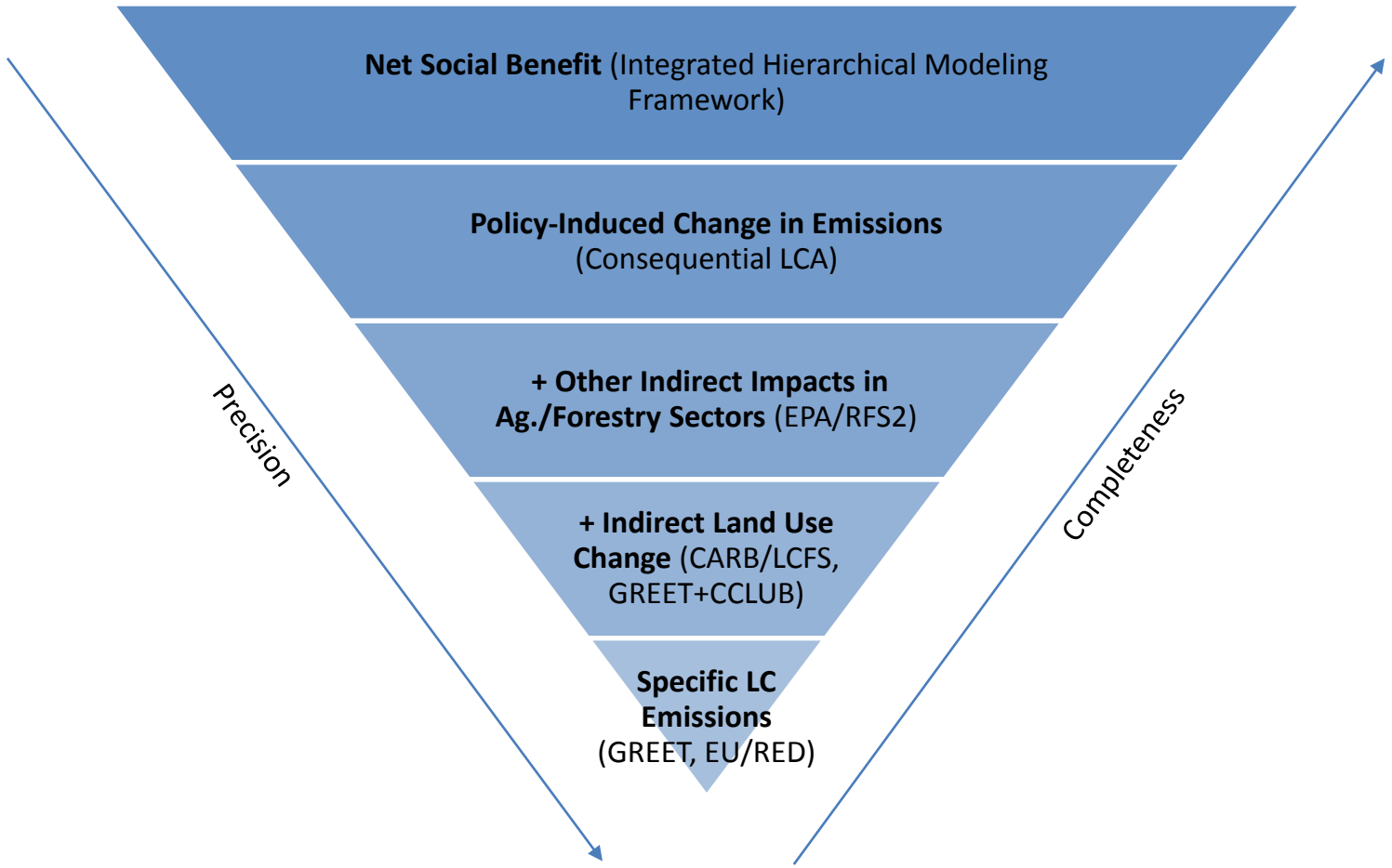
- Jet fuel can generate RINs under the program
  - If it meets the criteria specified in the RFS regulations, including lifecycle GHG emissions reductions and use of qualifying renewable biomass feedstocks
- EPA does not use jet fuel when setting annual volume requirements but obligated parties can use jet fuel RINs for compliance
- List of approved jet fuel pathways:

	Feedstock	Process Technology	D-Code
1	Soybean oil	Hydrotreating	D4 or D5
2	Oil from annual cover crops		
3	Algal oil		
4	Biogenic waste oils/fats/greases		
5	Non-food grade corn oil		
6	Camelina sativa oil		
	Cellulosic biomass from…	Any	D7
7	Crop residue		
8	Slash, pre-commercial thinnings and tree residue		
9	Annual cover crops		
10	Switchgrass		
11	Miscanthus		
12	Energy cane		
13	Arundo donax		
14	Napier grass		
	Cellulosic components of…		
15	Separated food waste		
16	Separated MSW		

LCA System Boundaries and Models Used



Precision and Completeness of Biofuel Evaluations (Adapted from Figure 2 in Creutzig et al. 2012)



EISA dictated our approach to LCA for the RFS analysis but there is a range of approaches and tools that could be used to evaluate the LCA of biofuels

Creutzig, F., Popp, A., Plevin, R., Gunnar, L., Minx, J, Edenhofer, O. 2012. "Reconciling top-down and bottom-up modelling on future bioenergy deployment. *Nature and Climate Change*. Published online March 4, 2012