

Alternative Jet Fuel Supply Chain Analysis

Project A001C

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Alternative Jet Fuel Supply Chain Analysis - CORSIA Fuels Support

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Cost Share Partner: NESTE Corporation

Research Approach:

Using agricultural resources for SAF production may induce world-wide land use changes with consequent greenhouse gas emissions (GHG)

The life cycle analysis (LCA) for Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) has two components: **Core LCA** and **induced land use changes (ILUC) emissions**

- Use GTAP-BIO model to evaluate **ILUC emissions**
- Use economic models for **Techno Economic Analysis (TEA)**
- Use actual observations and biochemical/terrestrial ecosystem models to estimate the above and under ground carbon stocks to support ILUC calculation

Objective:

- Provide data and modeling practices to **estimate ILUC values for each proposed SAF pathway**
- Develop required economic analysis to **assess economic feasibility and profitability of each SAF pathway**

Project Benefits:

- Improve ILUC estimation method for SAF pathways
- Develop methodologies to calculate direct land use change (DLUC) emissions
- Improve emissions factor databases and modeling approach

Major Accomplishments (to date):

Provided required data and modeling practices to **estimate regional and global ILUC values for about 50 alternative SAF pathways and developed required land use analyses** to support the ICAO/CAEP WG5 of activities and goals

Future Work / Schedule:

- Develop a new data base for GTAP-BIO using the standard GTAP data base which represents the global economy in 2017
- Revise the GTAP-BIO model: Expected to add a Joint Production Function (**JPF**) to represent corn-soybean multiple cropping in Brazil
- Update and reassess ILUC values for all CORSIA SAF pathways, **about 50 pathways**

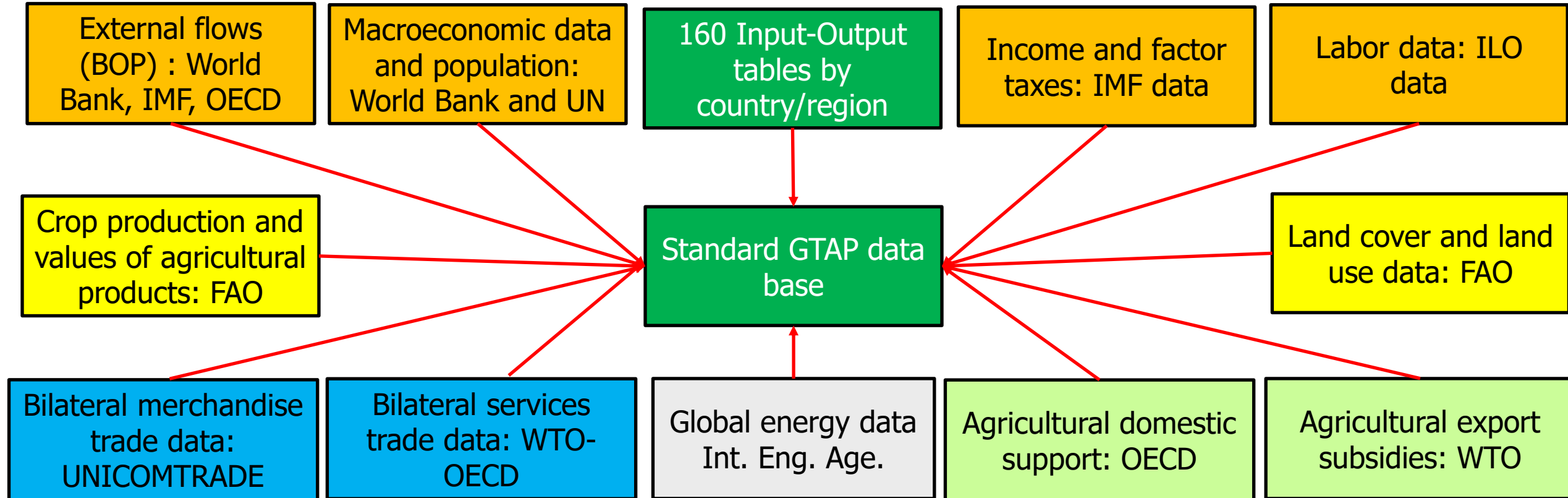
Introduction

- The ICAO/CAEP WG5 is planning to update the ILUC values for all examined SAF pathways determined over the past 10 years, it is about 50 regional and global pathways.
- To achieve this goal, three major tasks should be accomplished in 2026:
 - Develop a new data base for GTAP-BIO using the standard GTAP data base which represents the global economy in 2017
 - Revise the GTAP-BIO model to consider a Joint Production Function (**JPF**) to represent the corn-soybean multiple cropping in Brazil
 - Develop a large number of simulations and assess ILUC values for about 50 regional and global ILUC values.
- To accomplish the above tasks we need to follow a long process
- This presentation briefly introduces this process.



Standard GTAP data bases and their data content

- The latest published standard GTAP data base represents the 2017 global economy
- A standard GTAP data base assembles and represents a wide range of data items:



Economic sectors in standard GTAP data bases

Paddy rice	Coal	Wood products	Electrical eqpt.	Communication
Wheat	Oil	Pulp, paper etc.	Other mach. & eqpt.	Financial services
Other cereals	Gas	Refined oil etc.	Other manu.	Insurance
Vegetables & fruits	Other minerals	Pharmaceuticals	Electricity	Real estate
Oil seeds	Red meat	Other chemicals	Gas distribution	Other bus. services
Sugar cane & beet	White meat	Rubber & plastics	Water	Recreation etc.
Plant-based fibers	Vegetable oils	Other mineral prod.	Construction	Public Admin.
Other crops	Dairy products	Ferrous metals	W & R trade	Education
Beef etc.	Processed rice	Other metals	Hotels, rests. etc.	Health
Poultry, pork, etc.	Refined sugar	Metal products	Warehousing etc.	Dwellings
Raw milk	Other food	Mot. vehicles & parts	Land transport	
Wool etc.	Beverages & tobacco	Other trp. eqpt.	Sea transport	
Forestry	Textiles	Electronic eqpt.	Air transport	
Fishing	Clothing			
	Leather products			

- The standard GTAP data bases do not explicitly represent biofuels, their corresponding economic activities, and other essential variables that are needed to assess biofuel production and policy

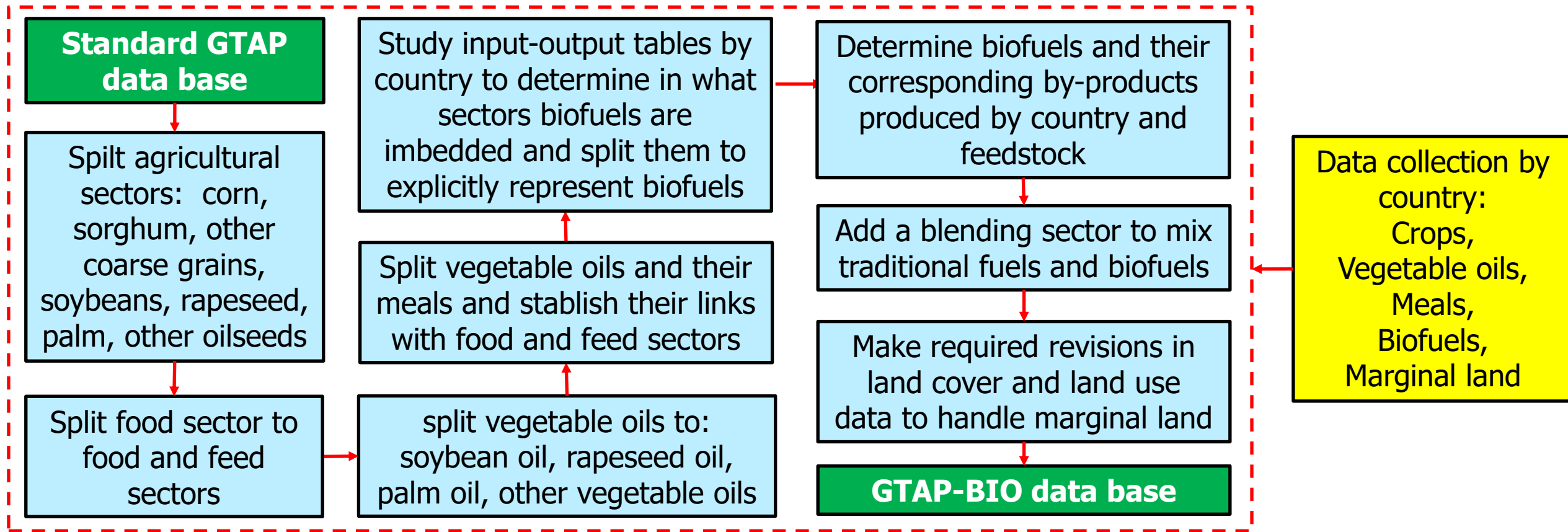


GTAP-BIO data bases

- During the past 20 years, a method has been developed and used to create the GTAP-BIO data bases to be able to assess the economic and environmental effects of biofuel production and policy
- The GTAP-BIO data bases usually represent only traditional biofuels that are produced commercially. Advanced biofuels (e.g. SAF pathway) are not included
- A 2017 GTAP-BIO data base has been developed and used for assessing the US biofuel policy practices
- Next slide represents construction of a typical GTAP-BIO data base.



Converting a standard GTAP data bases to a GTAP-BIO data base



2017 GTAP-BIO data base for CORSIA

- To support the CORSIA approach, SAF pathways should be added to the new GTAP-BIO data base
- The new data based should be further revised to represent Brazil's mono crops and joint corn-soybean activities. This requires data collection and assessment.
- Trusted data sources should be reviewed to obtain required data to split the joint corn-soybean activity from other cropping practices in Brazil.
- Over the past 10 years, using the CORSIA Core LCA assessments, we developed many Techno Economic Analyses (TEAs) for the hypothetical SAF pathways to incorporate them into the 2011 GTAP-BIO data base for CORSIA
- All those assessments should be revised for the 2017 data base as feedstock and fuel prices have changed in 2017 compared to 2011.



Modeling revisions and required simulations

- The GTAP-BIO model used for CORSIA should be revised to handle the joint production of corn-soybean
- The new GTAP-BIO model should be revised to handle all SAF pathways
- When the new data base and model are assembled, we need to run a large number of test simulations to assess the model performance and detect potential data problems
- The test simulations may detect model and data issues, suggesting additional revisions in the model or its data base
- Following the test simulations we need to develop final simulations to estimate land use changes for all SAF pathways



Converting land use changes to ILUC emission values

- After estimating land use changes for all SAF pathways, we need to convert them to ILUC emission values. We use the AEZ-EF model which is a carbon calculator to accomplish this task
- We have several research activities in progress to update this model according to the new available data sources
- We plan to use an updated version of the AEZ-EF model to calculate ILUC emissions values for all SAF pathway



Conclusions

- Major efforts are required to support the CORSIA plan for updating ILUC values for all SAF pathways according to the new available data sources
- The plan is to implement the revised ILUC values in the next phase of CORSIA which will begin in 2027
- To accomplish this task we need to follow a fast track to recalculate and update all ILUC values that we determined over the past 10 years
- This is an intensive work load and requires major support from the Ascent program



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