Development of an Upstream Inventory Tool

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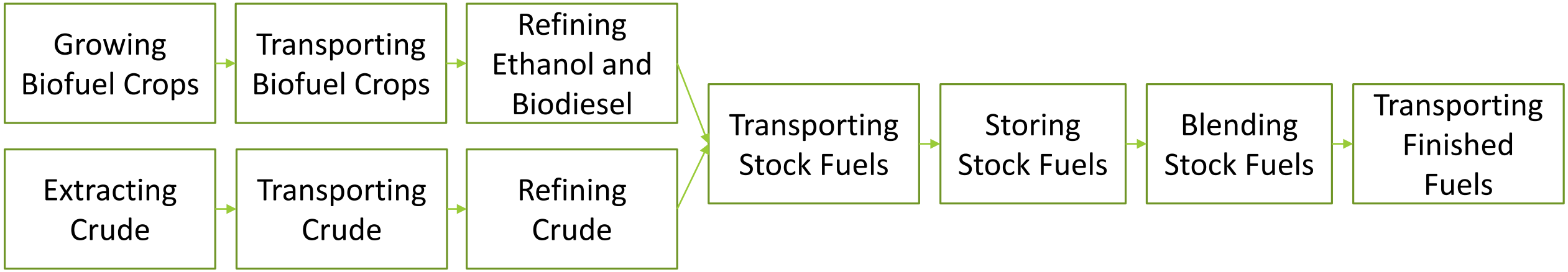
Definition of Scope of Upstream Tool

Upstream emissions are emissions from stationary and mobile sources that occur during the production and transport of mobile source fuels.



How the Upstream Tool Works

Location

- within the existing emissions modeling framework (EMF)

Structure

- new EMF structure called "modules" which contain algorithms specific for the upstream sectors

Outputs

1. Generate an "upstream" inventory for a given rulemaking or other research-based scenario

2. Produce scalars that can be applied to the EPA emissions modeling platform to create a control scenario for air quality modeling

Methodology: Emissions Modeling Framework (EMF)

What is the EMF?

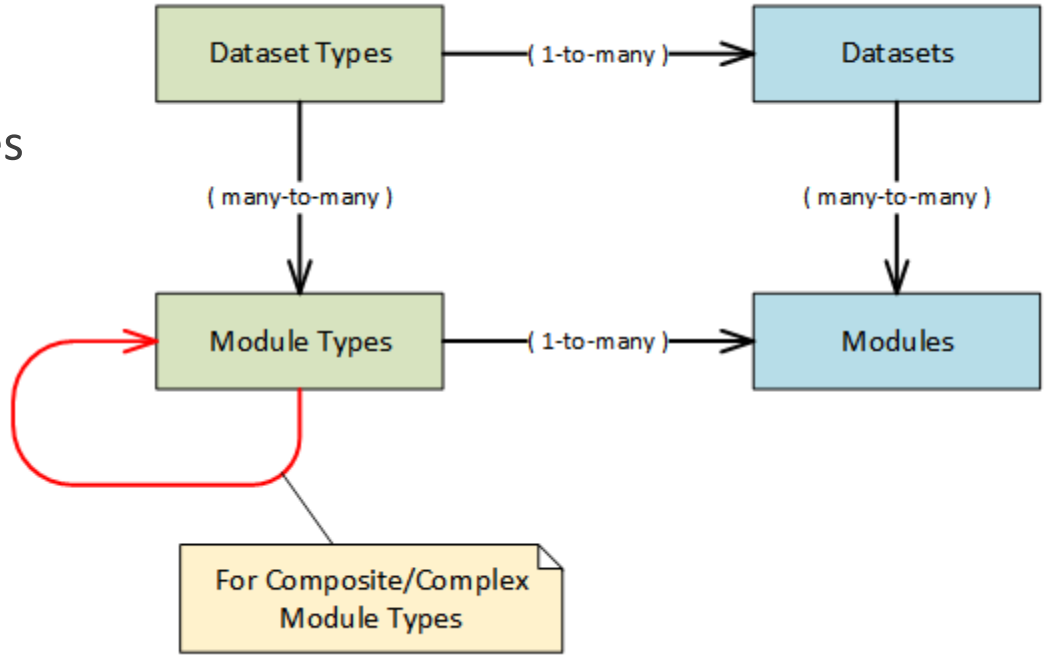
- Software package built for use in emissions work
- Manages and tracks changes in emissions data files
- Creates summaries and performs QA tasks on inventories

Currently used by EPA for emissions modeling, e.g.:

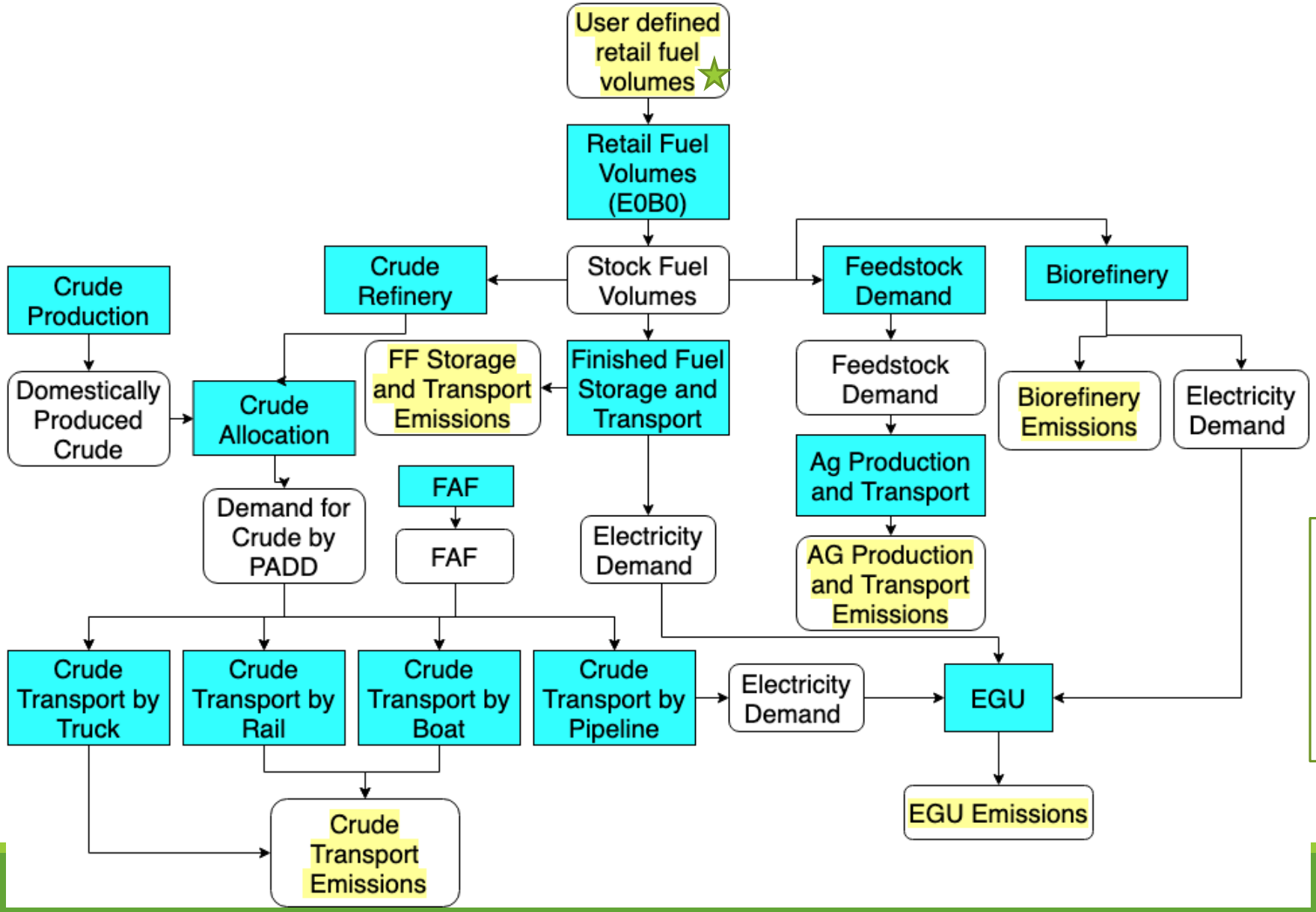
- SMOKE modeling
- Inventory projections via CoST (control strategy tool)

Used existing dataset type/dataset relationship

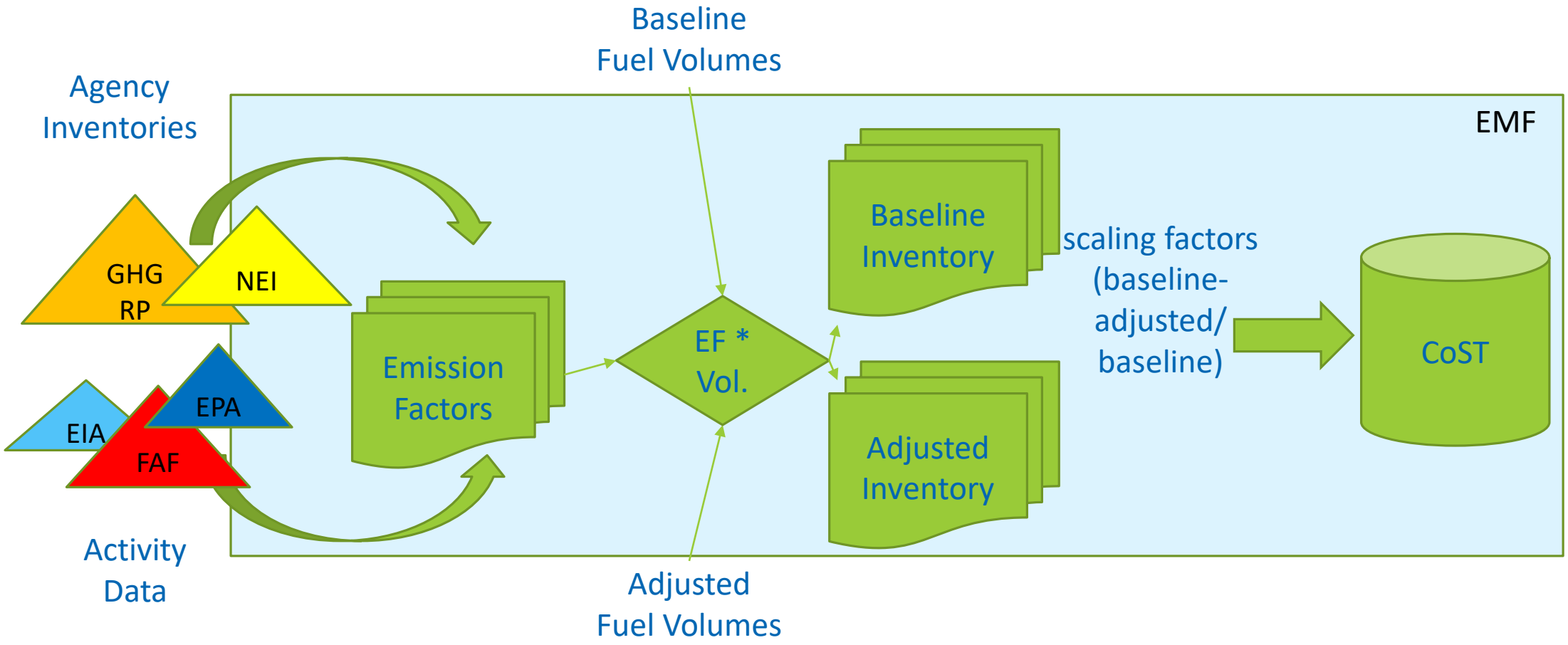
- Extended to module type/modules
- Module associates specific data with algorithm



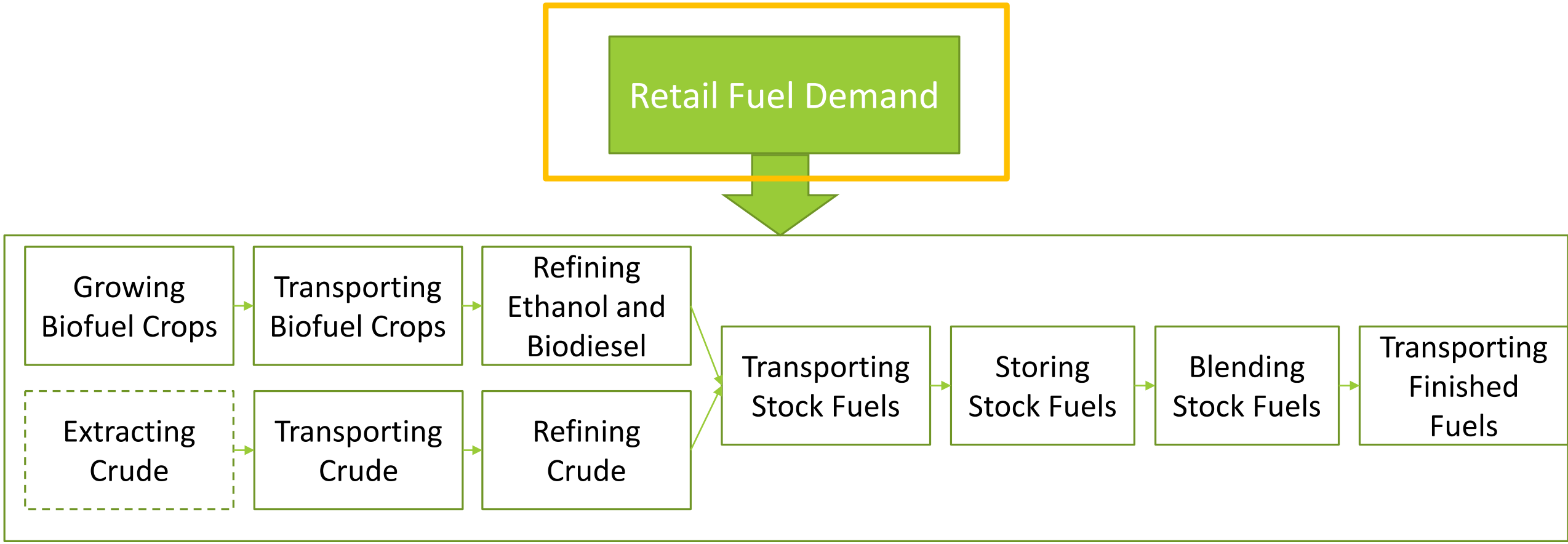
Detailed Module Map



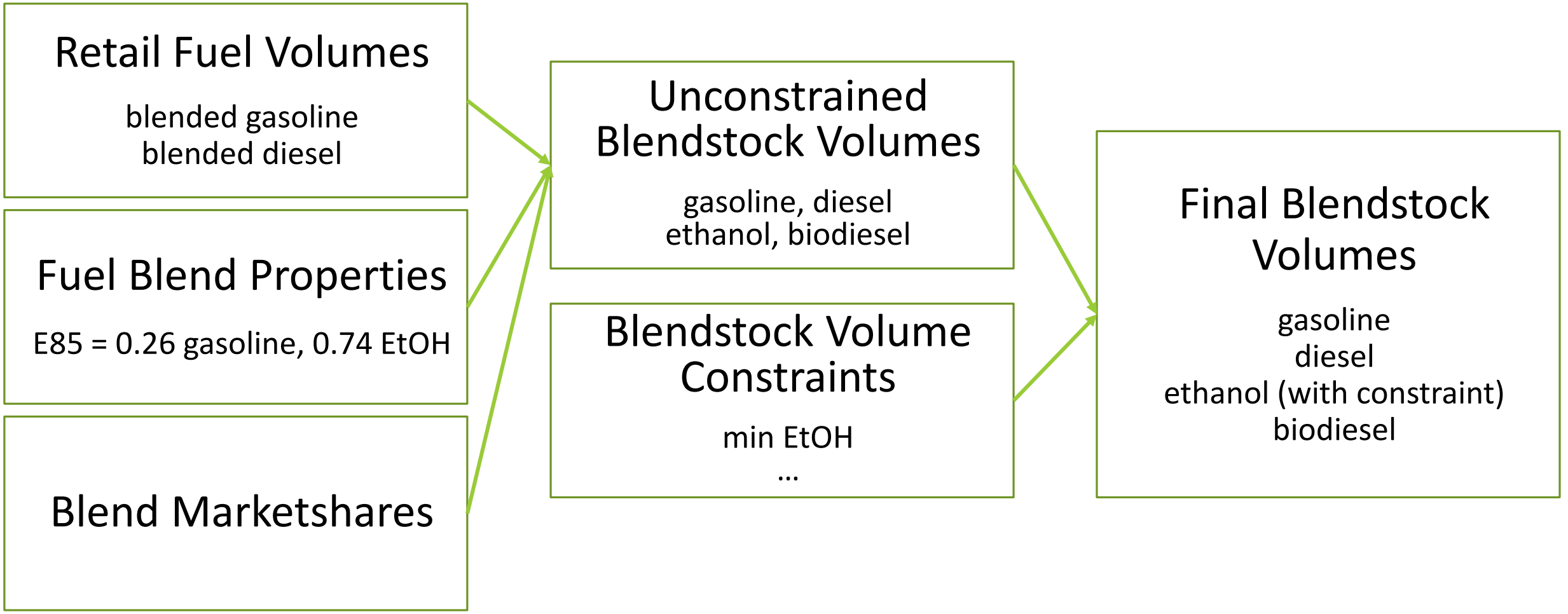
Methodology: Inventories and Scaling Factors



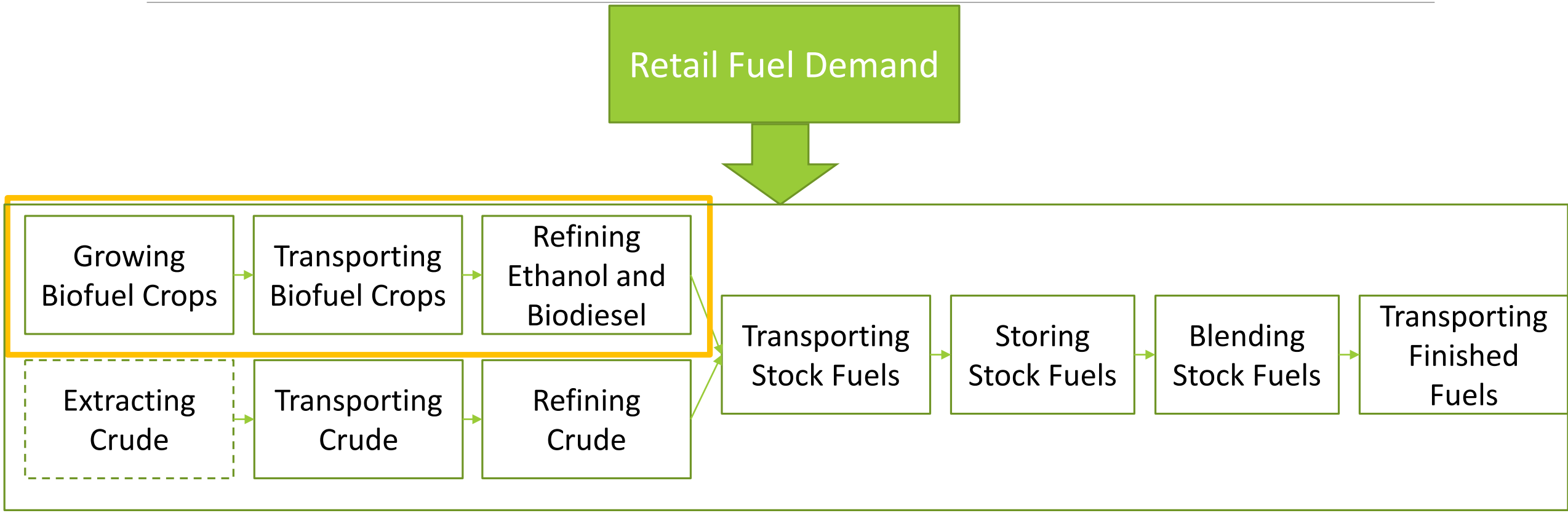
Upstream Tool: Retail Fuel Projection example



Retail Fuel Projection

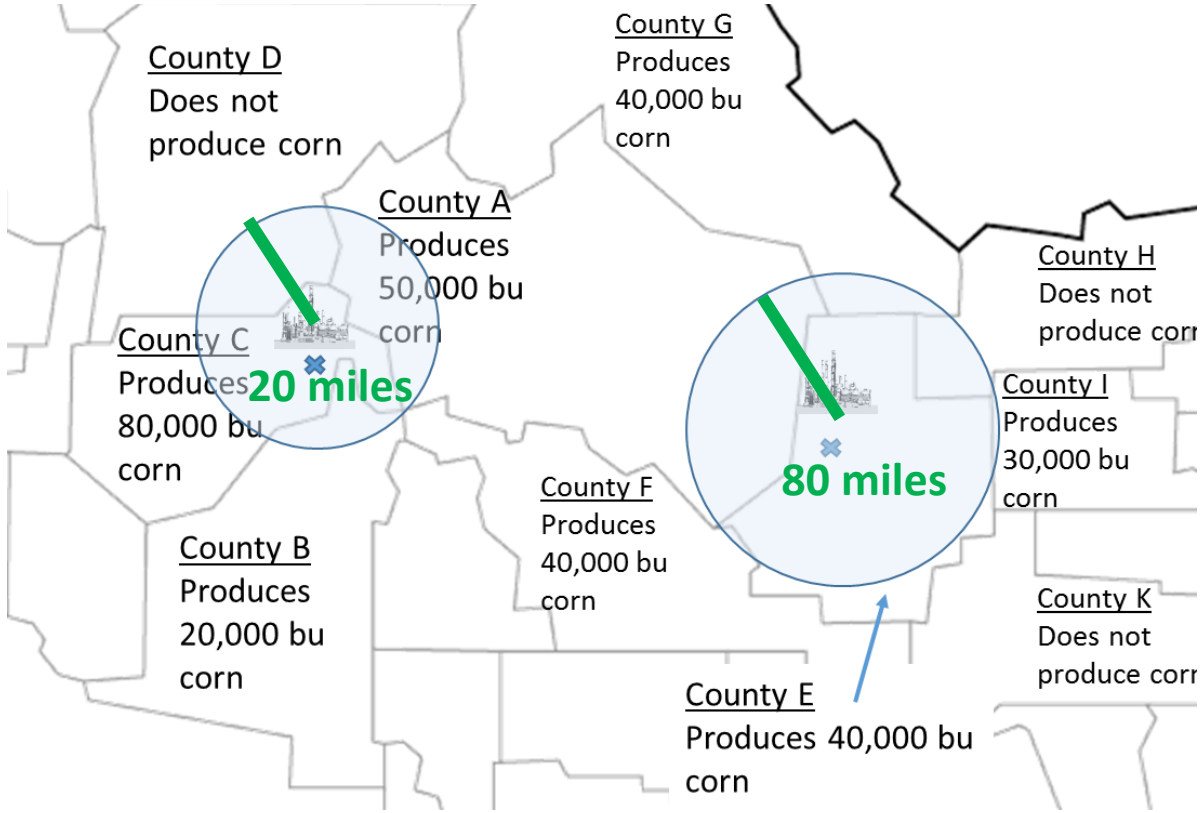


Upstream Tool: Biofuels example



Corn Feedstock Production and Transport

- Feedstock demand calculated from the biorefineries
- Feedstock production
  - Use USDA county data to determine available feedstock
  - emissions = feedstock demand x emissions factor
- Transport
  - Transport from the field to the refinery
  - emissions = feedstock demand x emissions factor (x distance scaling factor as appropriate)



Biorefinery Module

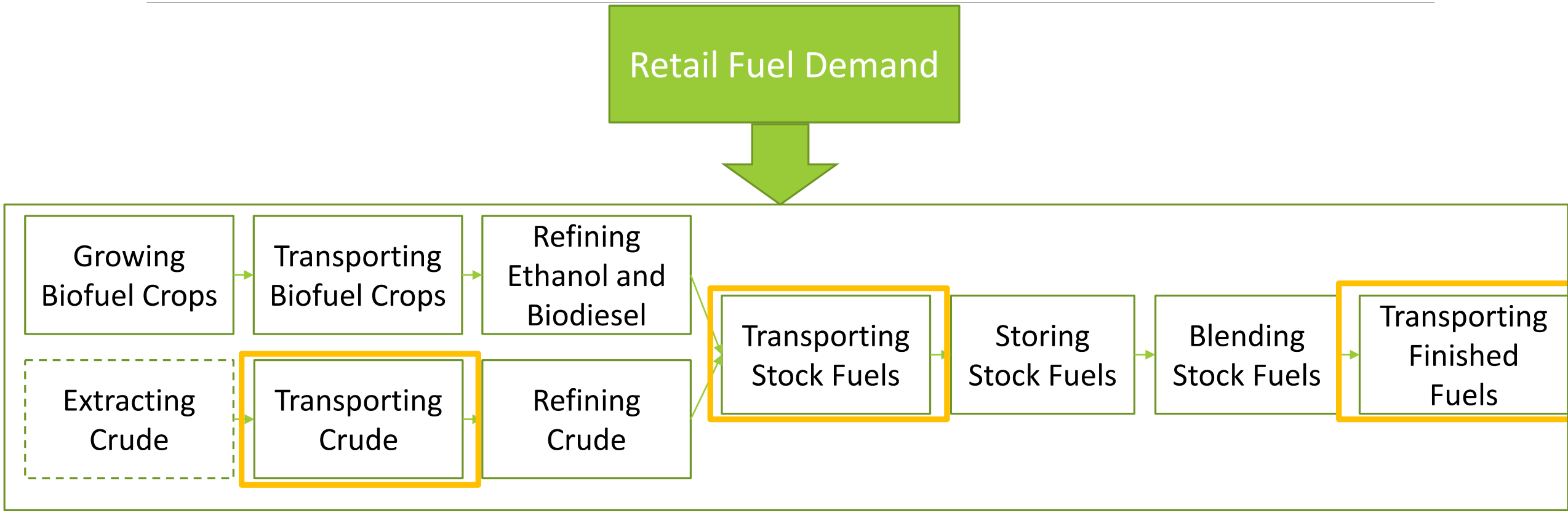
- Emission factors computed
  - Activity
    - EMTS data on production volume by process
  - Emissions
    - Facility specific emission factors based on NEI and GHG RP emissions where available
    - National EF based on biorefinery process

- Adjusted facility volume computed
  - Total volume of biofuel needed * (facility volume/total volume of biofuel for process)
    - Built in QA check to see if the volume exceeds the facility capacity

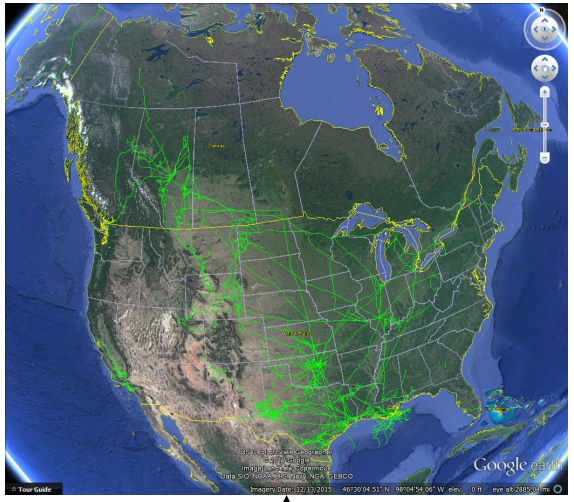
- Emissions Calculation

  Facility specific emissions factor * volume by facility = facility inventory

Upstream Tool: EGU and Pipeline Transport example



2016 Pipeline to EGU Example: Pipelines in Crude Transport



Crude Demand

Modal (rail vs. marine, pipeline vs. truck) splits, inter intra PADD movement shares

Freight Analysis Framework (FAF)

Tons to be transported (domestic and foreign pipelines)

Distance of transport and distance weighted diameter on a state-segment basis

Through-put through each pipe system and energy calculations

Pipeline system allocation factors

PennWell

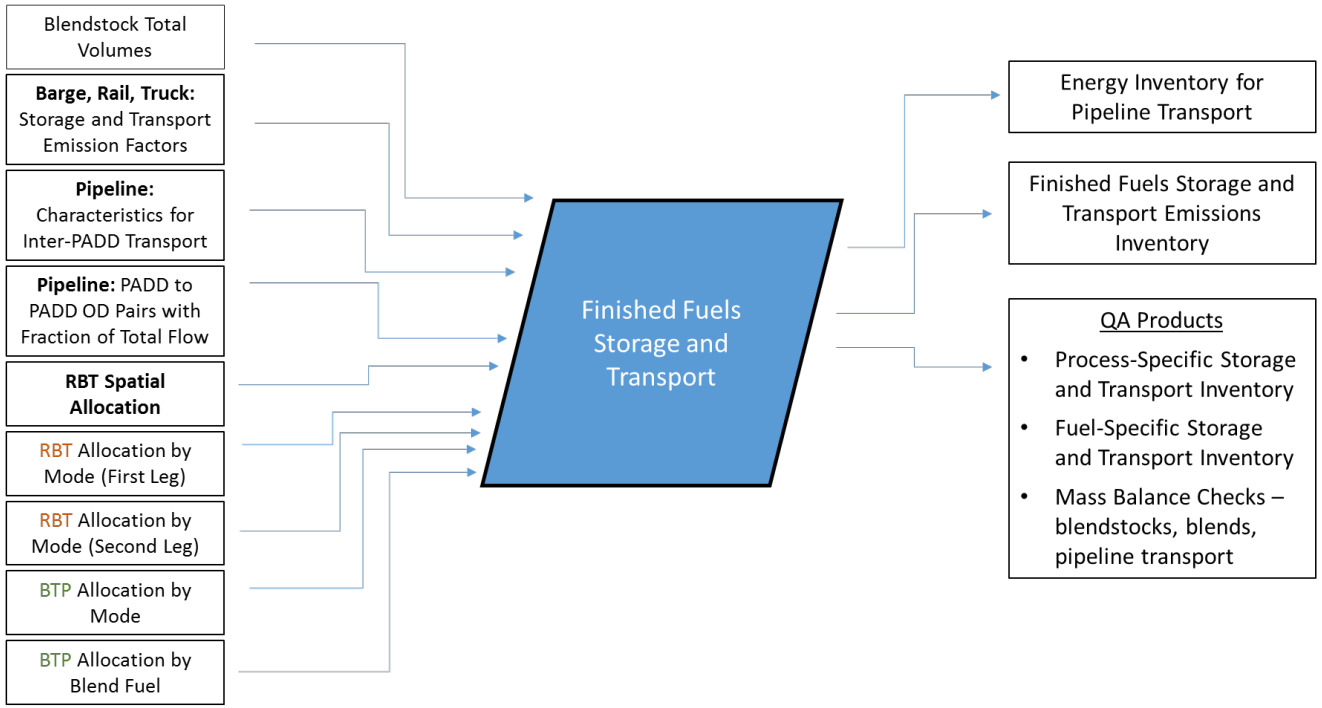
Geo-spatial analysis

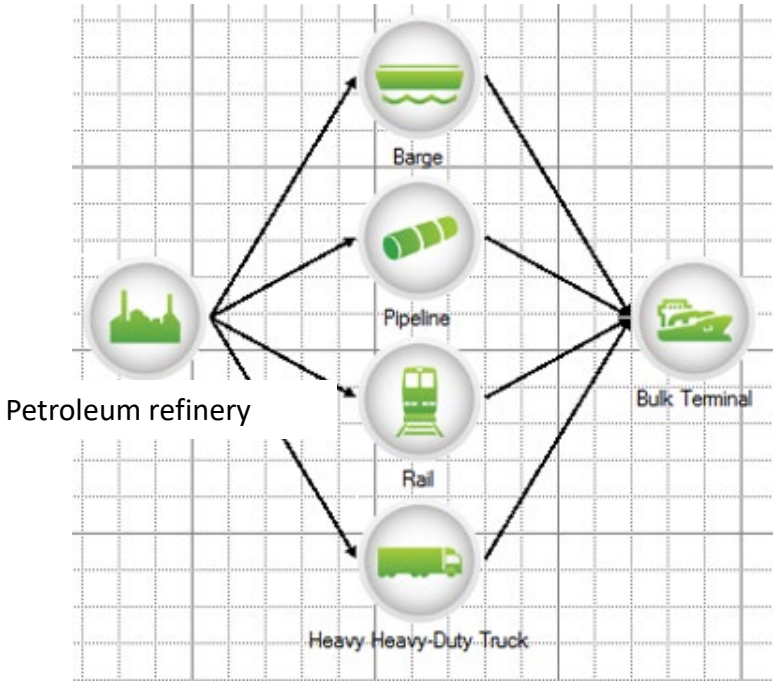
- Crude oil main line pipeline network

- **US state-level electricity energy use due to foreign and domestic pipelines**
- **Electricity use in foreign regions (Canada and Mexico)**

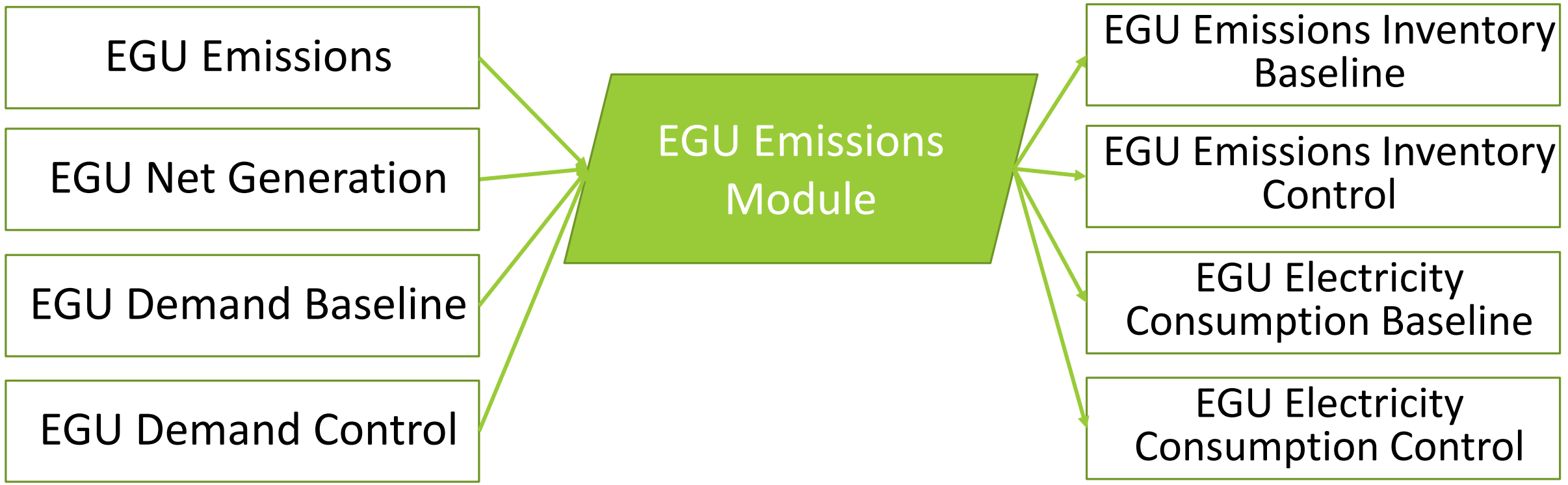
2016 Pipeline to EGU Example: Pipelines in Finished Fuel Transport

Finished Fuels Storage and Transport Module Type





EGU Module


EGU Emissions
EGU Net Generation
EGU Demand Baseline
EGU Demand Control
EGU Emissions Module
EGU Emissions Inventory Baseline
EGU Emissions Inventory Control
EGU Electricity Consumption Baseline
EGU Electricity Consumption Control

Benefits associated with Upstream Tool

- Transparency
  - algorithms and documentation easily available
- Documentation
  - data sources clearly identified within modules and in written documentation
- Repeatability
  - info on datasets used, date/time when model was run, etc are saved
- Flexibility
  - fuel volumes can be changed
- Sharing
  - inputs, algorithms and outputs can be packaged

Status and Future Work

- Base year modules mostly complete, working on projecting to future years
- Refining modules and documentation, not yet available
- Use in development of air quality modeling platform inventories

EMF documentation available at:

https://www.cmascenter.org/cost/

Acknowledgments

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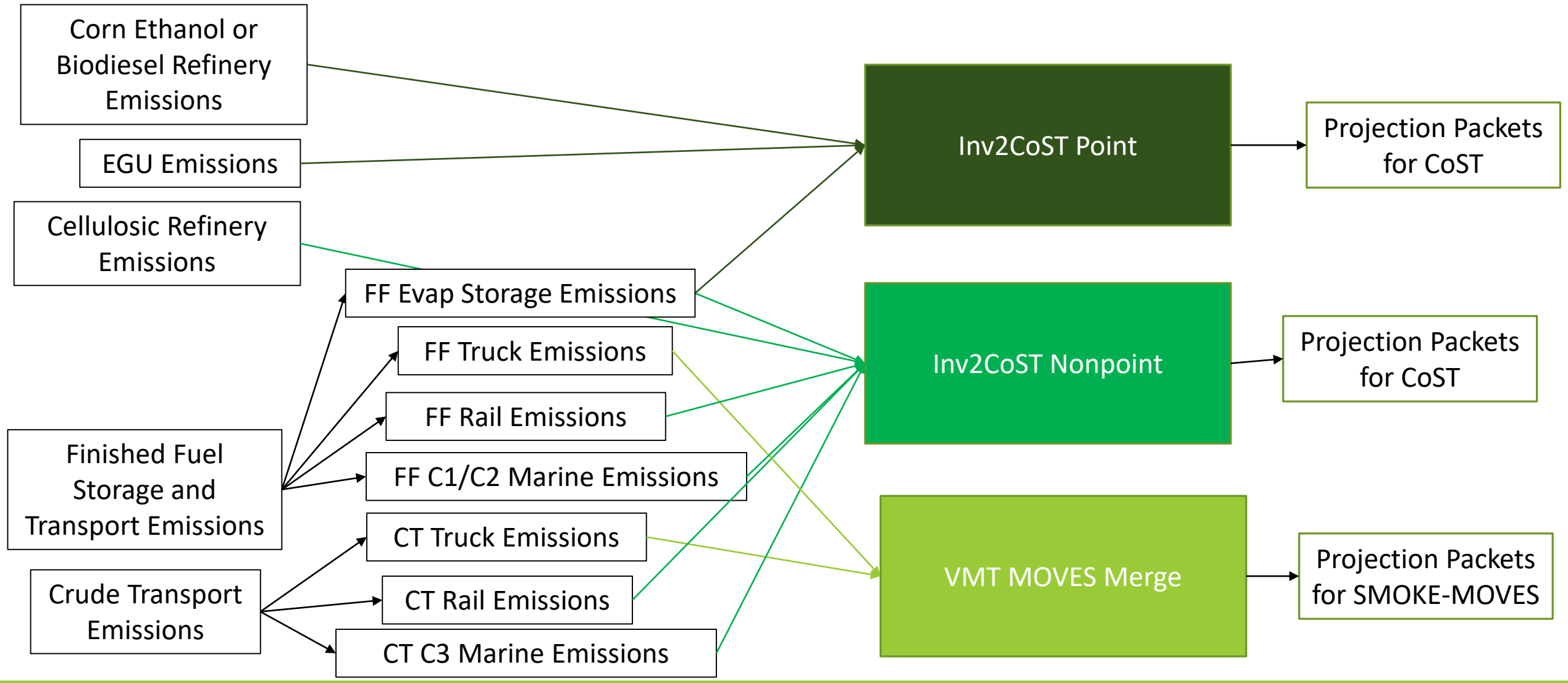
Volpe team: Anjuliee Mittleman, Matthew Pearlson, Ted Thrasher, Alexis Zubrow

Questions?

Extra Slides

Methodology: Scaling Factors from Upstream Tool



2016 Pipeline to EGU Example: Interface with EGU Module