Modeling of Biofuels in the Annual Energy Outlook (AEO)

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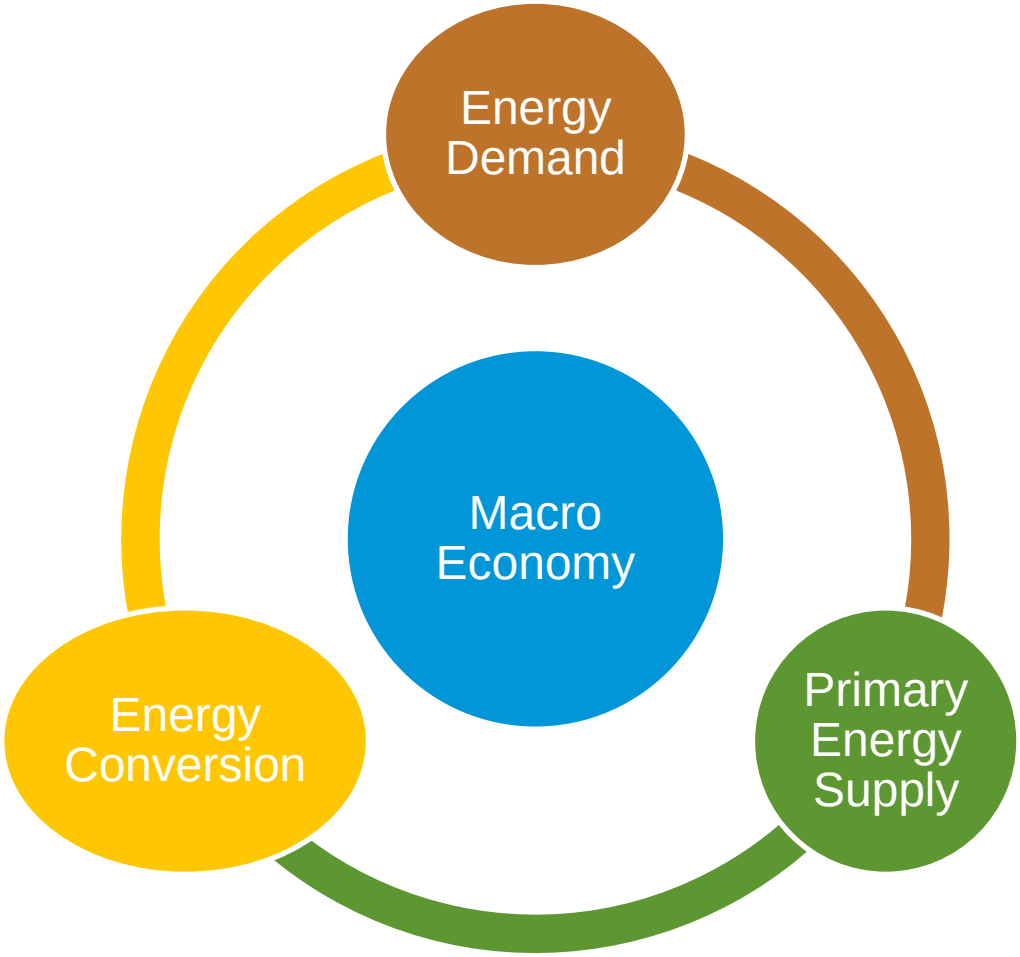
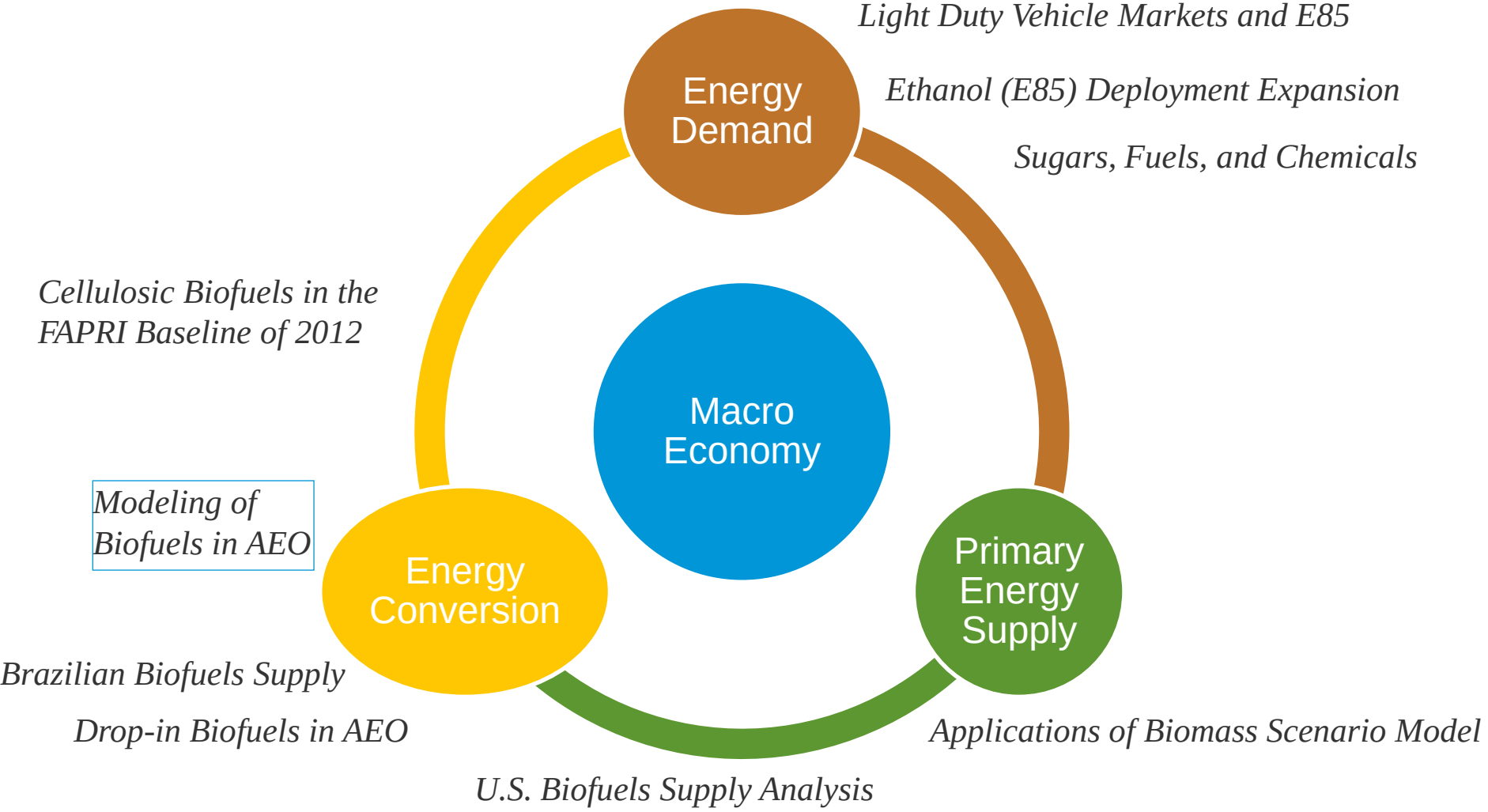
Overview

- Modeling the **total** energy market in AEO
- Modeling **liquid fuels** markets in AEO
- Modeling **biofuels** in AEO
  - Biofuel categories
  - Three main drivers
- Conclusion

A general model of the entire U.S. energy economy

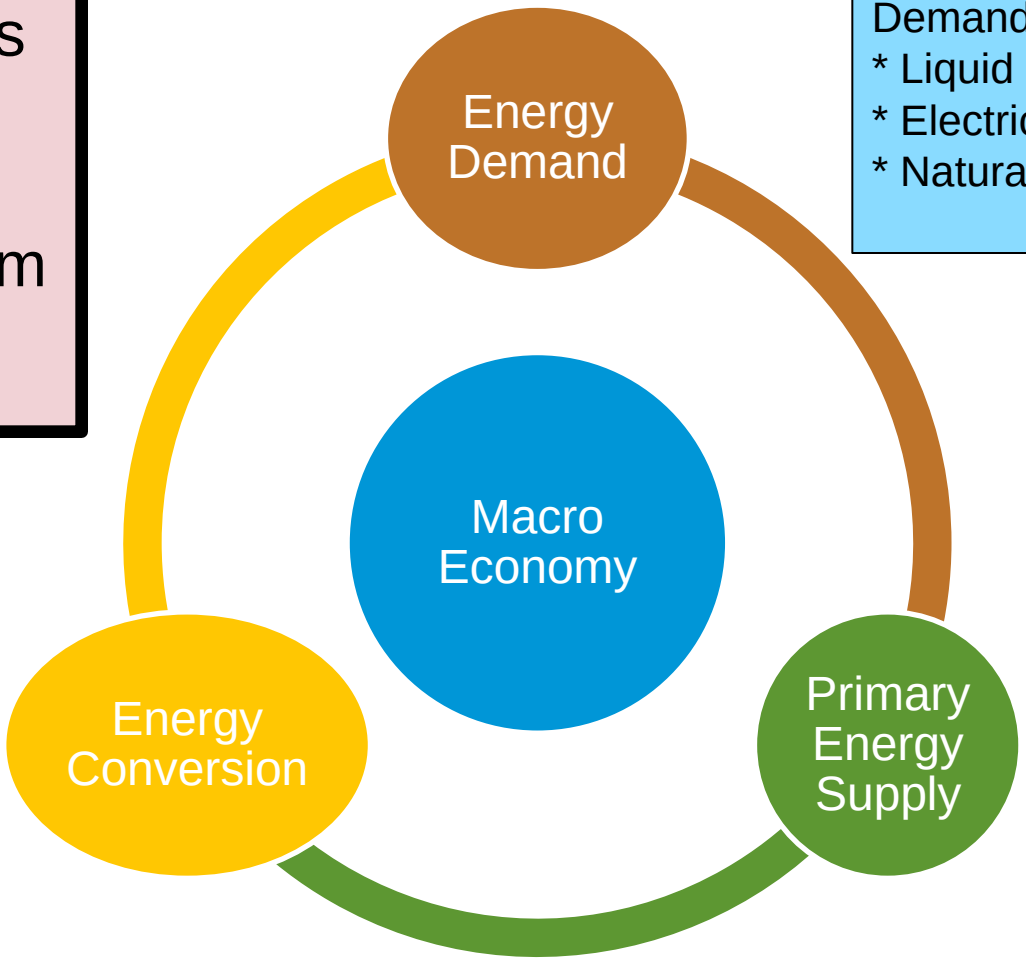


Today's presentations



EIA models the entire U.S. energy economy for the AEO

AEO uses NEMS, a market equilibrium model



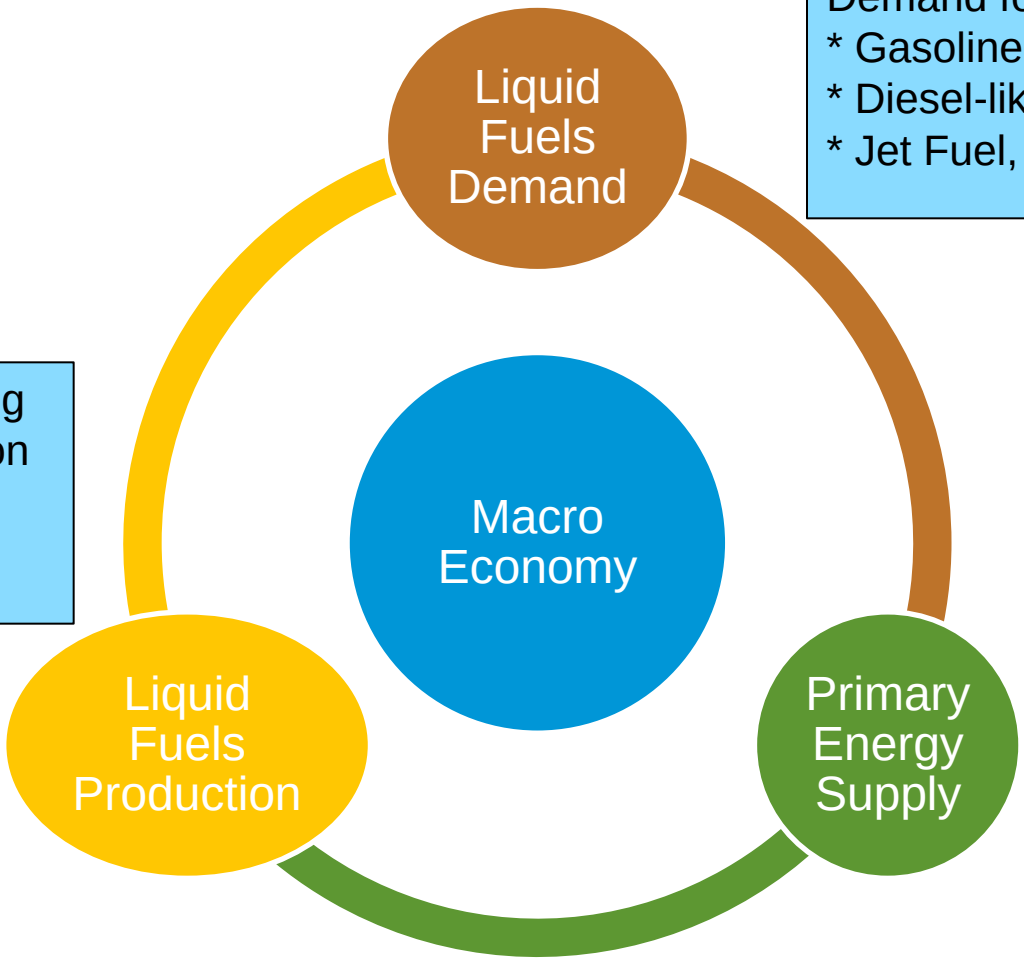
Demand for:
* Liquid Fuels
* Electricity
* Natural Gas

Liquid Fuels Production

Electricity Generation

Supply of:
* Crude Oil
* Renewables
* Natural Gas
* Coal
* etc.

Liquid fuels energy market

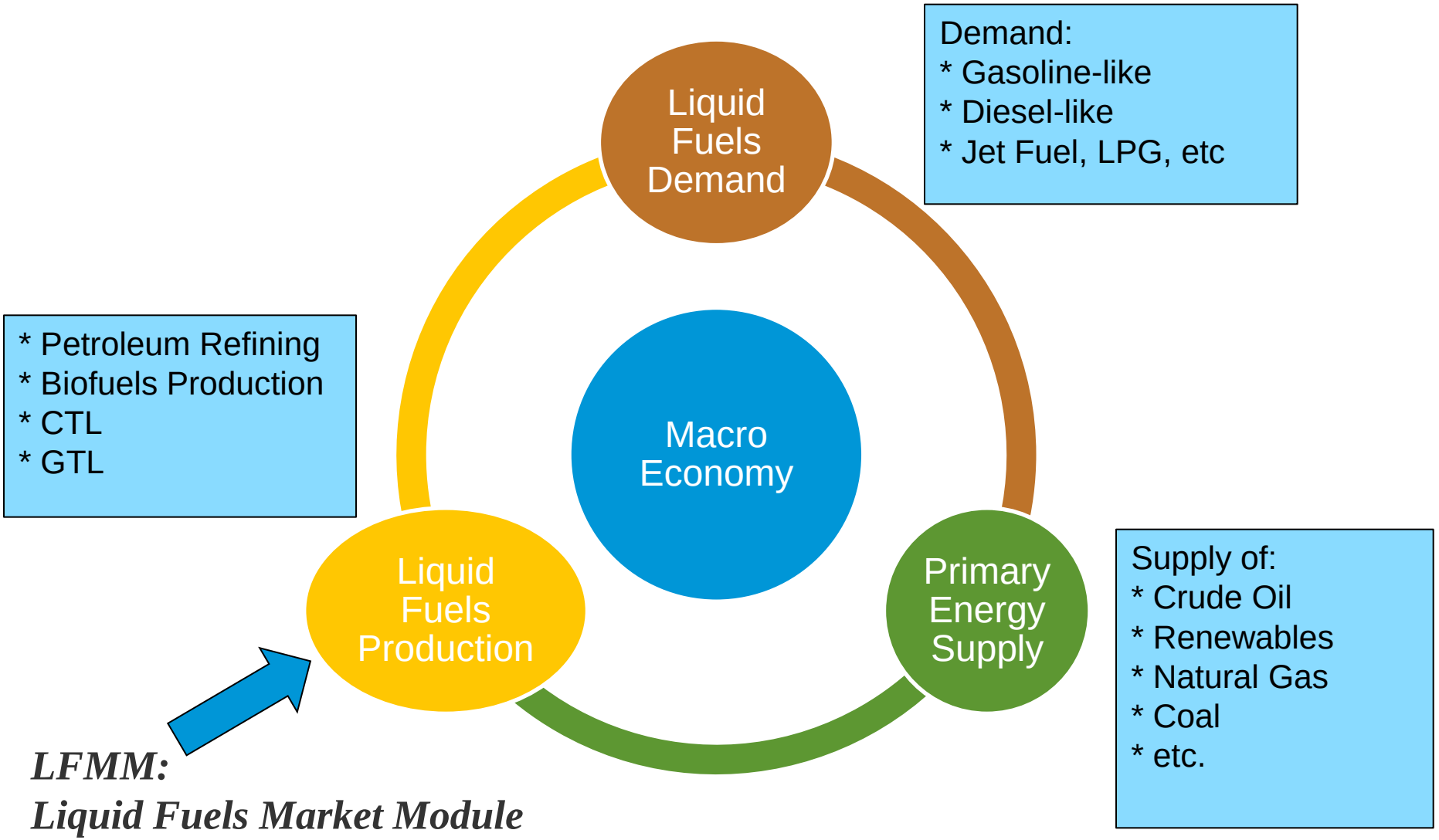


Demand for:
* Gasoline-like
* Diesel-like
* Jet Fuel, LPG, etc

* Petroleum Refining
* Biofuels Production
* CTL
* GTL

Supply of:
* Crude Oil
* Renewables
* Natural Gas
* Coal
* etc.

Liquid fuels energy market: LFMM is a new NEM module



LFMM's main component is a Linear Program

Input

- Demands for liquid products (gasoline, diesel, jet fuel, etc.)
- Statutory and Regulatory requirements (RFS2, for example)
- Prices of primary energy (crude oil, etc.)

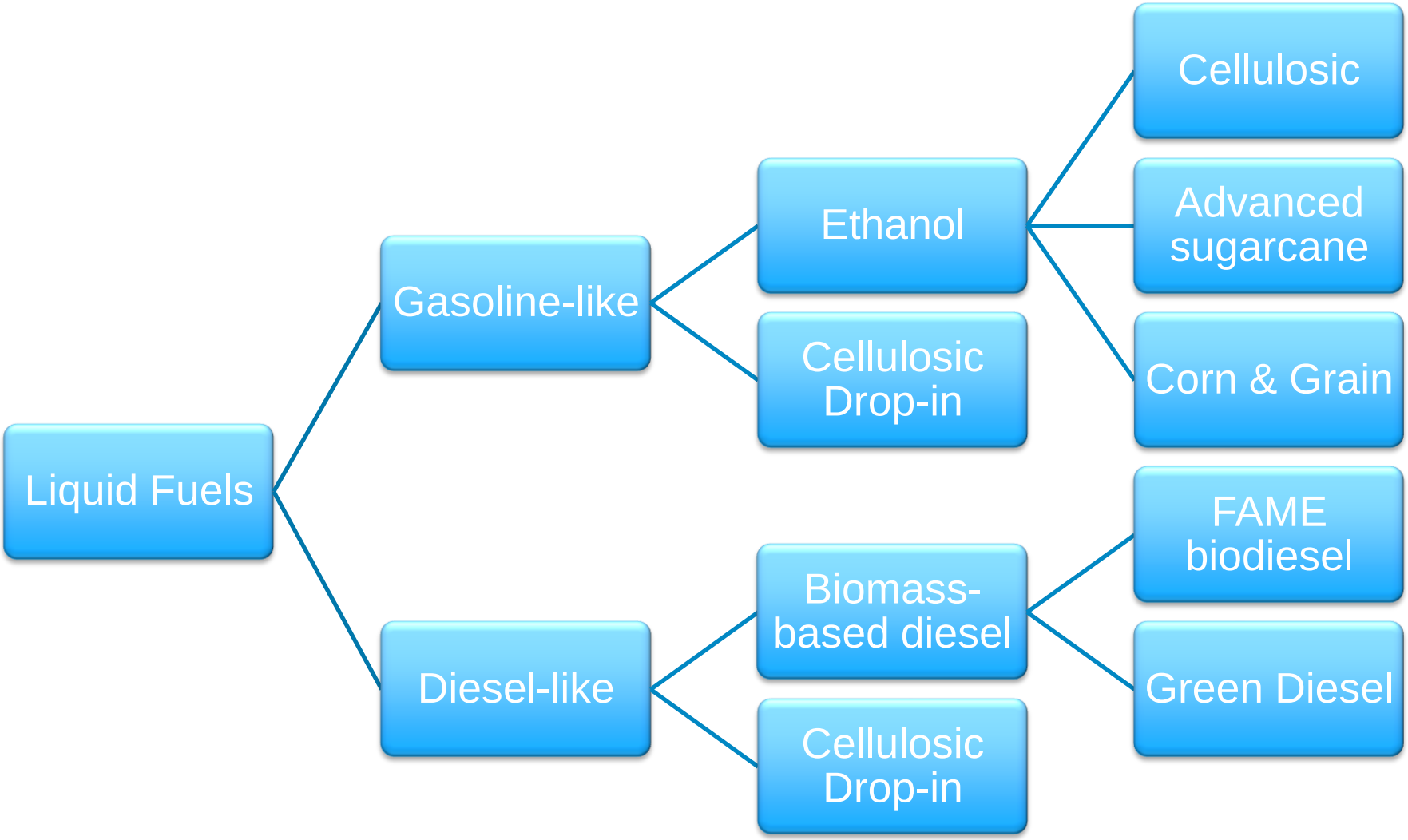
LP

- Minimize cost to meet fuel demands and legal requirements
- Cost categories include capital costs and operating costs

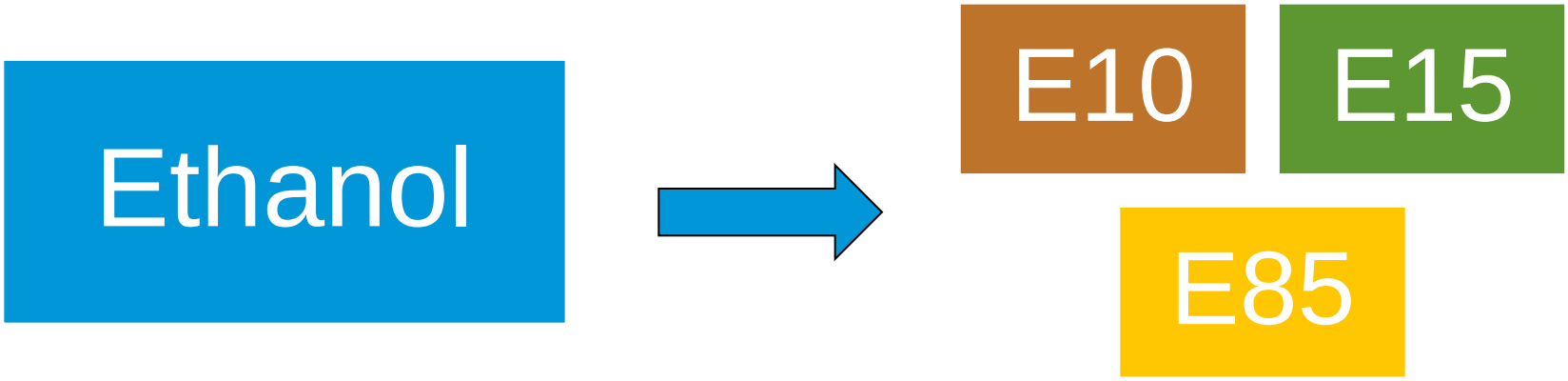
Output

- Prices of end-use products
- Production plan (how much each type of crude to use, how much of each type of ethanol to produce, where to produce, etc.)

A variety of biofuels are modeled in LFMM



For use as motor fuel, ethanol must be blended with gasoline blendstock to make end-use products E10, E15, or E85



Main drivers of AEO results for biofuels

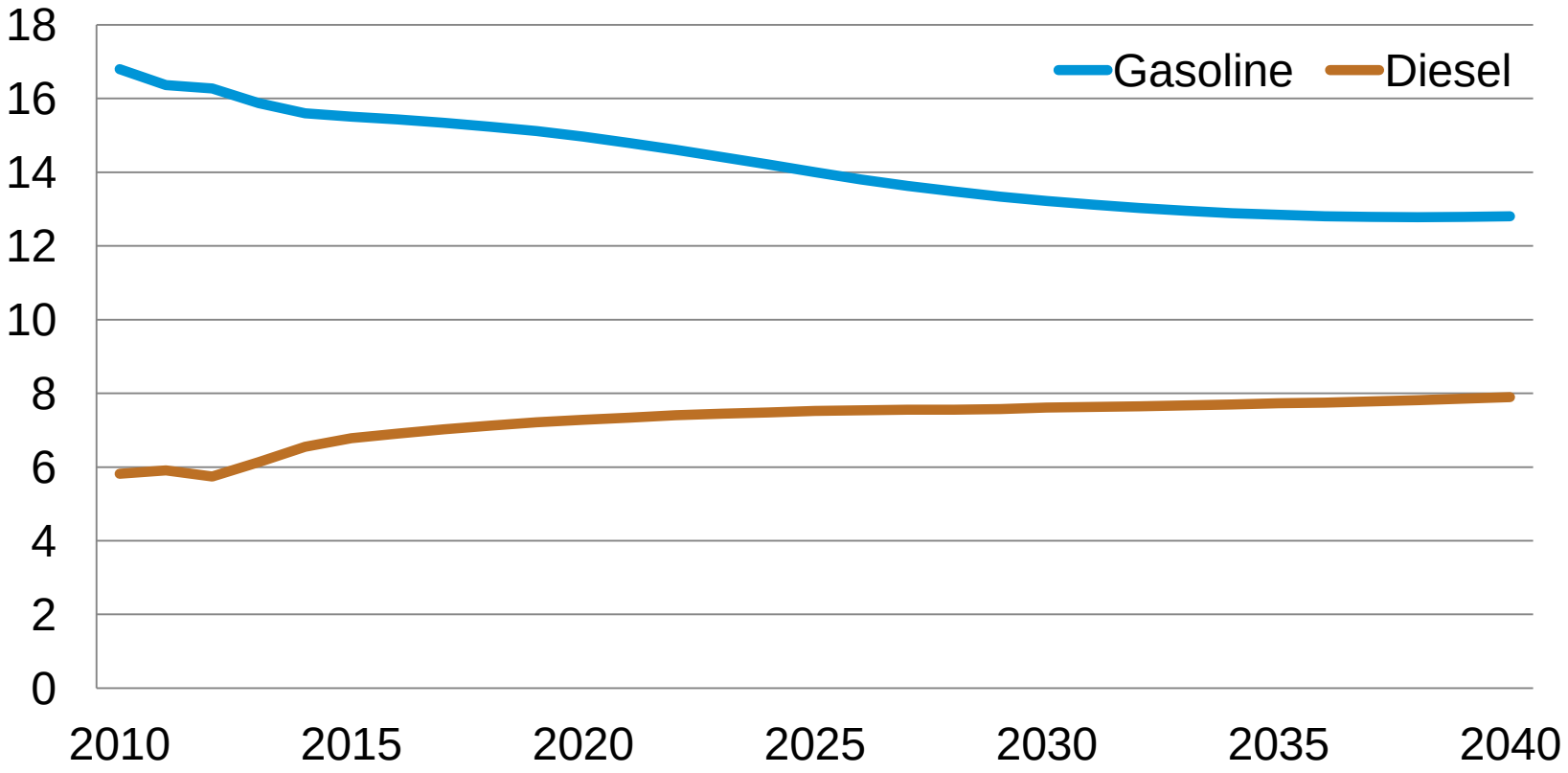
Potential Market Size (Demand)

Government Laws and Regulations

Competition with Other Fuels and Other (non-fuel) Uses

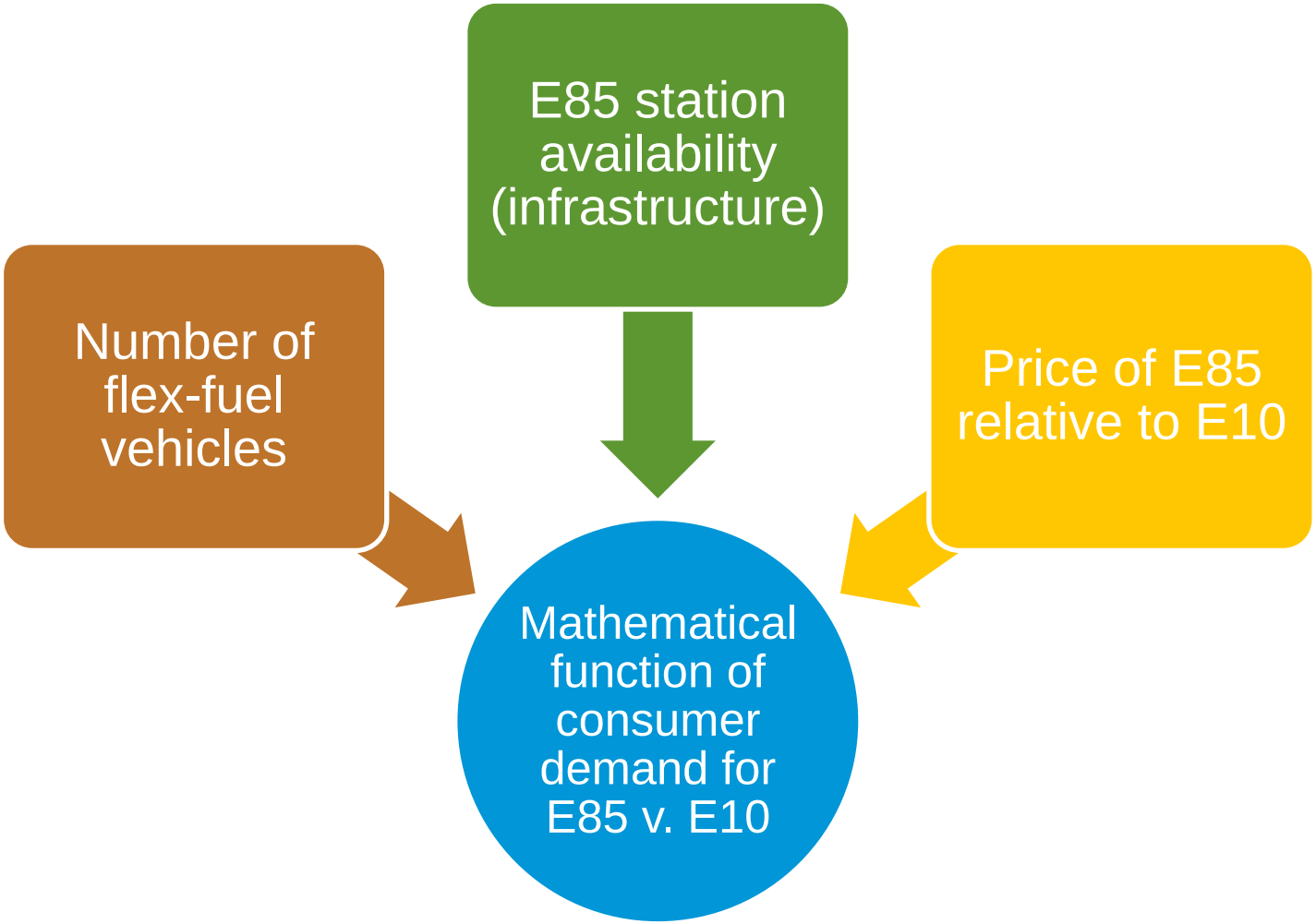
EIA projects declining gasoline use and slowly increasing diesel use through 2040

Transportation fuel demand
Quad Btu per year



Source: AEO2013 Early Release, Energy used in transportation

Market size: NEMS models total consumer demand for E85 v. E10 using a mathematical function with three inputs



EIA projections assume current Laws and Regulations

RFS2

- Nested yearly volume targets for biofuels (total, advanced, cellulosic, biomass-based diesel)
- **Subject to yearly adjustment by EPA**
- **Under certain circumstances, the EPA is required to issue cellulosic biofuel waivers**

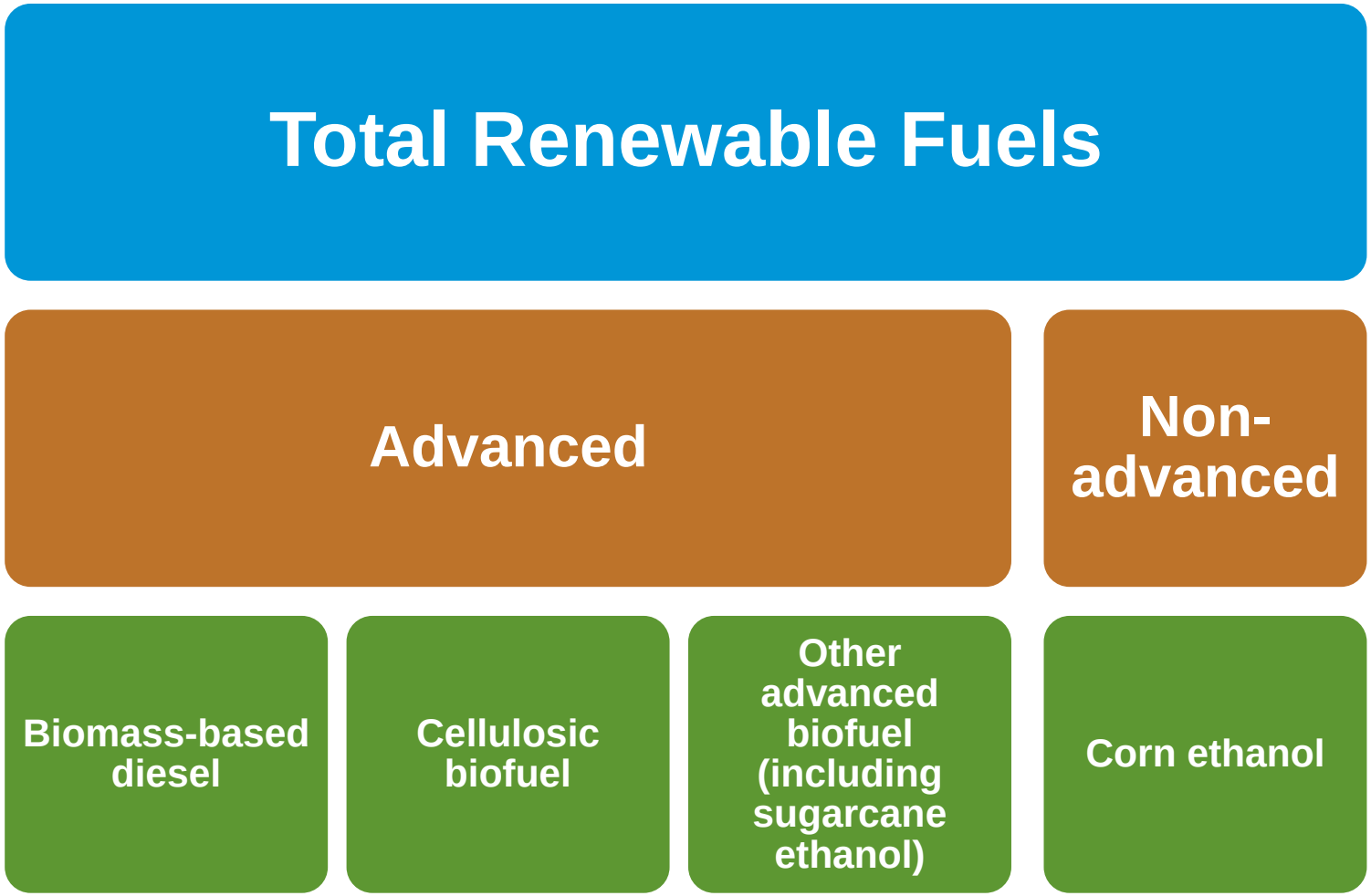
California LCFS

- Yearly carbon-intensity targets for California motor gasoline and diesel

Federal Taxes and Tariffs

- Ethanol tariffs have expired
- Most ethanol tax breaks have expired, except some related to cellulosic ethanol production
- Biodiesel tax credits have been renewed for another year

Laws and Regulations: The four RFS2 volume targets are expressed as nested constraints in the LFMM LP



Laws and Regulations:
EPA has flexibility in administering RFS2

- In any given year, the EPA has broad authority to decrease one or more of the applicable volumes for the following year. The EPA also has the authority to increase the biomass-based diesel mandate.
- If the EPA changes a sub-category's applicable volume, it is *not* required to change the nesting category's volume.
- If, after 2015, the EPA reduces an applicable volume by 50% in a single year, or by 20% in two consecutive years, then it is required to reduce that applicable volume in the following years.
- If EPA reduces the applicable volume for cellulosic biofuels for a given year, then it **must** make available cellulosic waivers at a price specified in the RFS statute.

Biofuels compete with other fuels. Cellulosic biofuels also compete against biochemicals, electricity

Cellulosic biofuels, biochemicals, electricity

- Classified as both RFS Cellulosic and RFS Advanced.
- Cellulosic ethanol competes for a limited gasoline blend pool.
- Ramp-up of cellulosic bio**fuel** production could be delayed due to production of higher-margin bio**chemicals** (not explicitly modeled in AEO)
- Biomass can be burned to generate electricity

Corn ethanol

- Currently, most ethanol blended into E10 is (inexpensive) corn ethanol

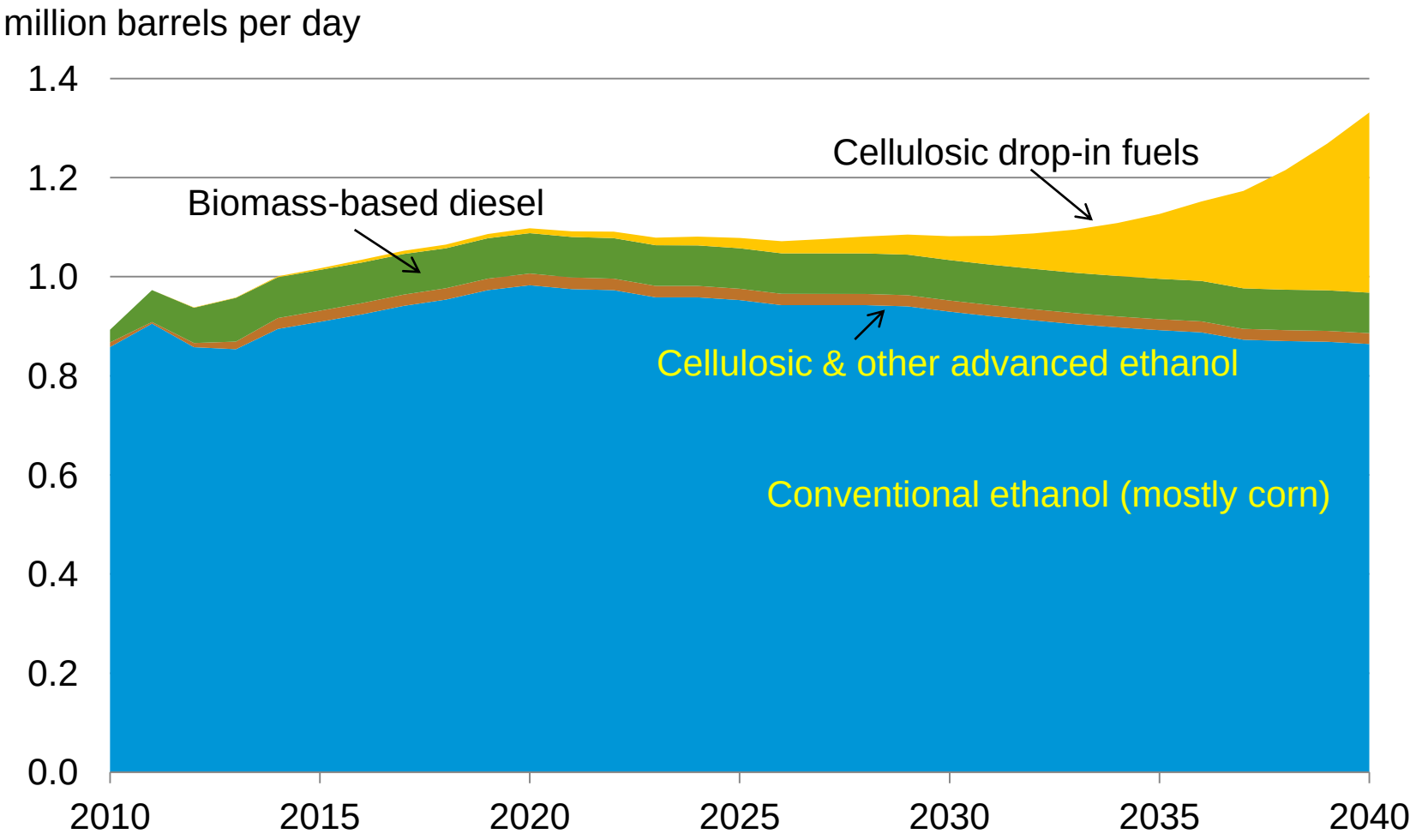
Sugarcane ethanol (mainly from Brazil)

- RFS Advanced biofuel
- Competes for a limited gasoline blend pool

Biomass-based diesel

- RFS Advanced biofuel

U. S. domestic biofuels production is steady through 2030, and then increases, particularly cellulosic drop-in biofuels



Source: AEO2013 Early Release

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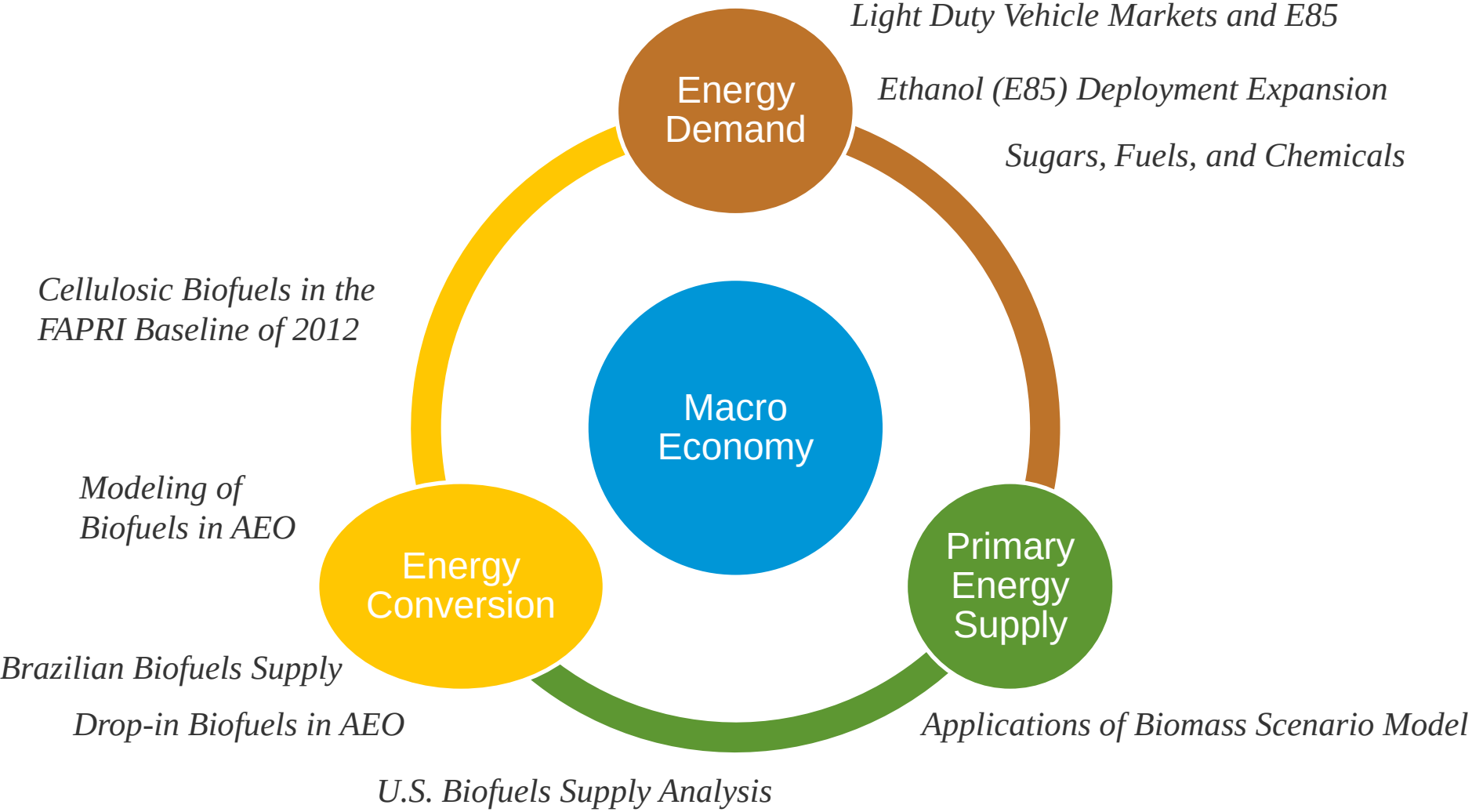

For more information

U.S. Energy Information Administration home page | *www.eia.gov*

Short-Term Energy Outlook | *www.eia.gov/steo*

Annual Energy Outlook | *www.eia.gov/aeo*

International Energy Outlook | *www.eia.gov/ieo*

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