

Implementation of the Renewable Fuel Standard (RFS) in the Liquid Fuels Market Module (LFMM) of NEMS



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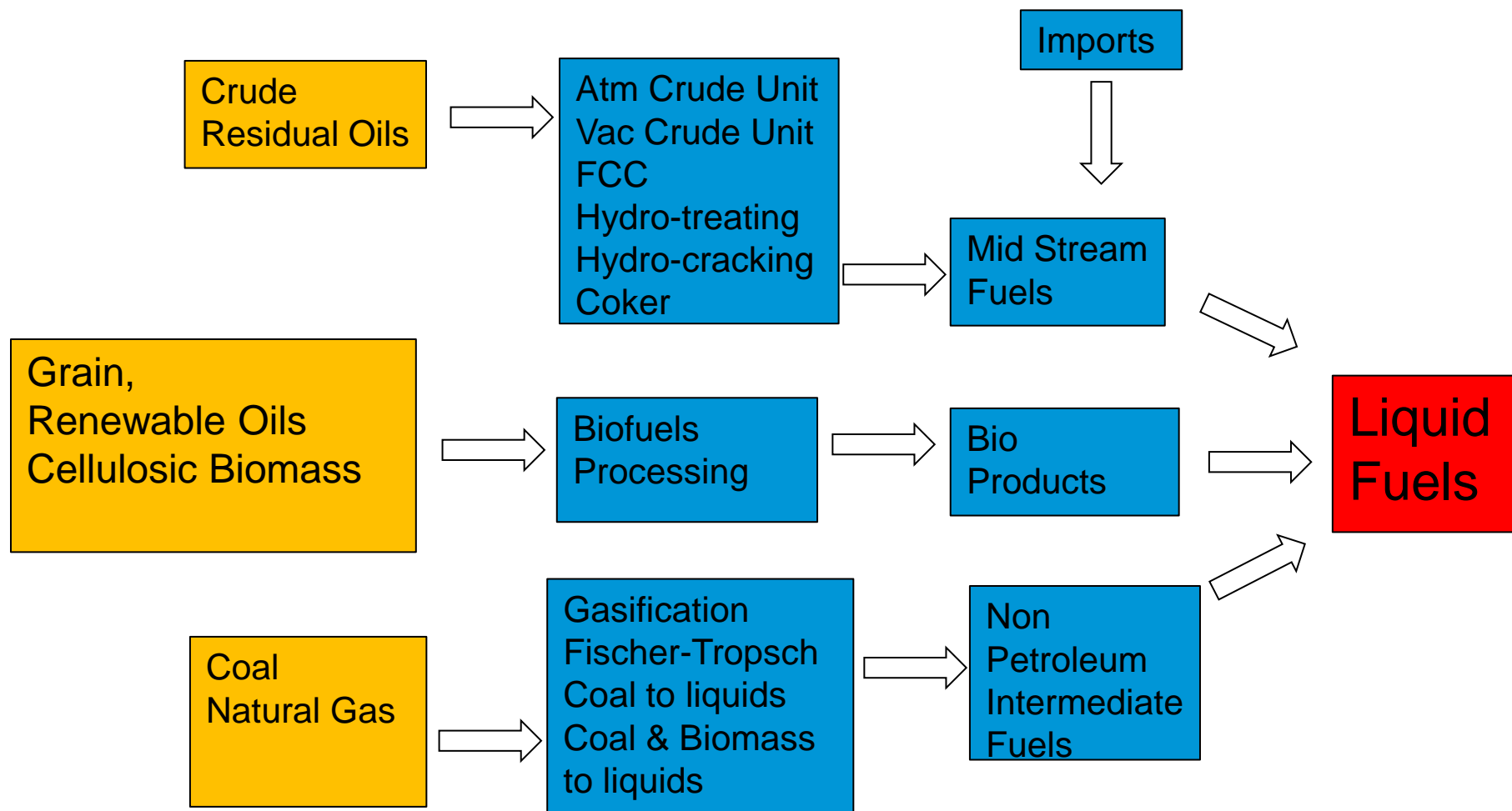
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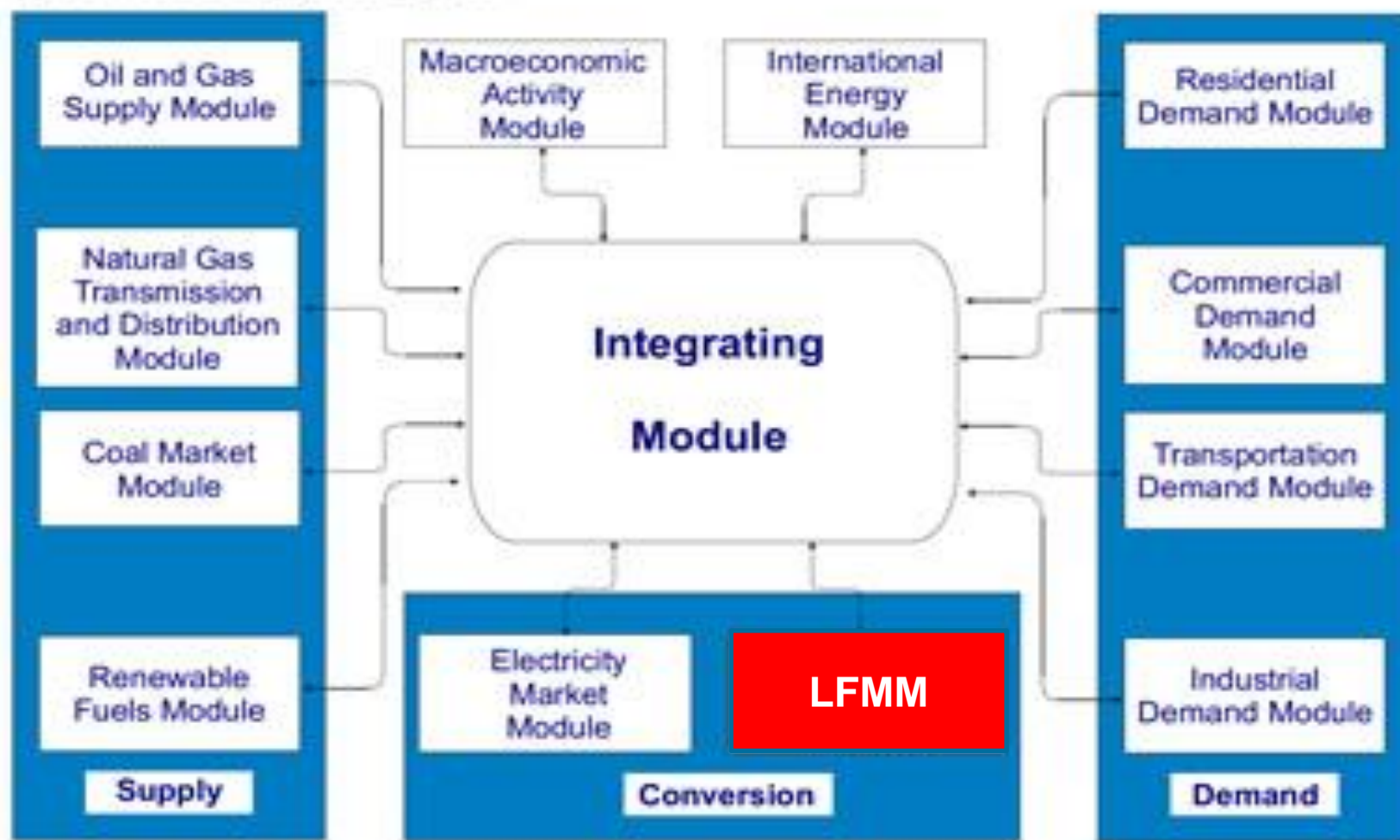
LFMM / NEMS overview

- LFMM is a mathematical representation of the U.S. liquid fuels market (motor gasoline, diesel, biofuels, etc.). EIA analysts use LFMM to project motor fuel prices and production approaches through 2040.
- LFMM is a cost-minimization linear program (LP). For a given set of fuel demands, LFMM will find the least-cost means of satisfying those demands, subject to various constraints (such as the RFS).
- LFMM is part of the National Energy Modeling System (NEMS), which is a computer model of the U.S. energy economy. EIA uses NEMS to produce the **Annual Energy Outlook** and to perform special studies throughout the year.

LFMM flows



NEMS – a model of the U.S. energy economy



Advanced Biofuels modeled in LFMM

- Ethanol (for blending into E10/E15/E85)
 - Cellulosic ethanol
 - Sugarcane ethanol
- “Distillate” (for blending into diesel, etc.)
 - Biodiesel – from soy, yellow grease, other renewable oils
 - Renewable diesel – from soy, yellow grease, other renewable oils
 - BTL – from cellulosic biomass
- Pyrolysis oil (for input to petroleum refinery)
 - from cellulosic biomass

RFS and LFMM

- The RFS comprises four nested/intersecting mandates:
 - Total renewable fuels
 - Advanced biofuels
 - Cellulosic biofuel
 - Biomass-based diesel
- In the LFMM linear program, RFS requirements are modeled as system-wide constraints, with the possibility of waiver purchases
- Benefits of producing biofuels in the least-cost LFMM model:
 - Don't have to purchase an RFS waiver
 - Don't have to produce an energy-equivalent quantity of fossil fuel

California LCFS

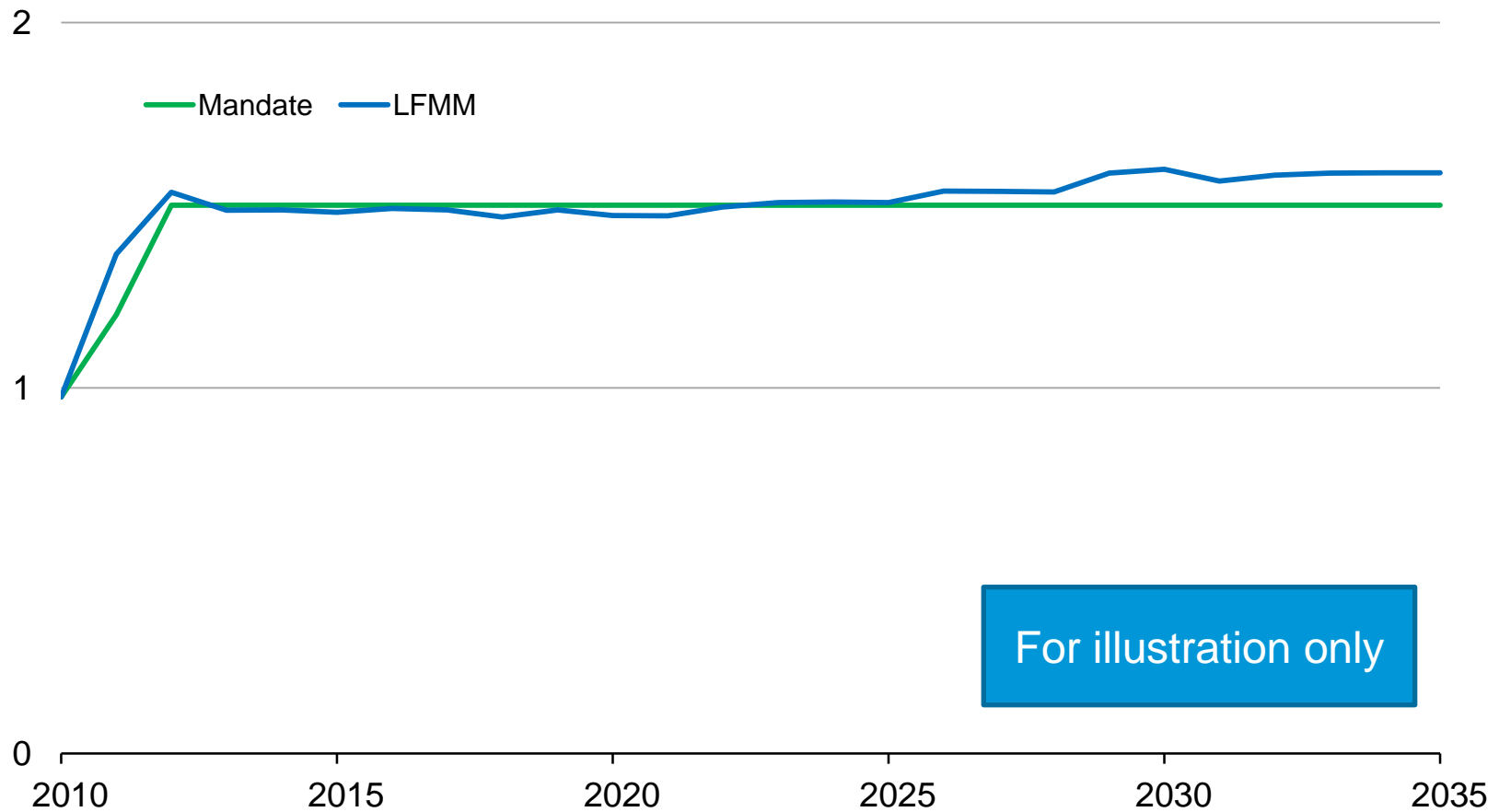
- The California LCFS requires “obligated parties” to reduce the average carbon-intensity (gCO₂e/MJ) of motor gasoline blends (E10, E85, etc.) and diesel they place into commerce.
- California provides the carbon intensity of each specific fuel component (sugarcane ethanol, corn ethanol, soy biodiesel, etc.). The allowed average carbon intensity of finished motor fuel decreases over over time.
- Sugarcane ethanol is a low-carbon fuel, according to the LCFS. This will make sugarcane ethanol a preferred gasoline blending component in California.
- The California LCFS will interact with the national RFS...

Sample run results

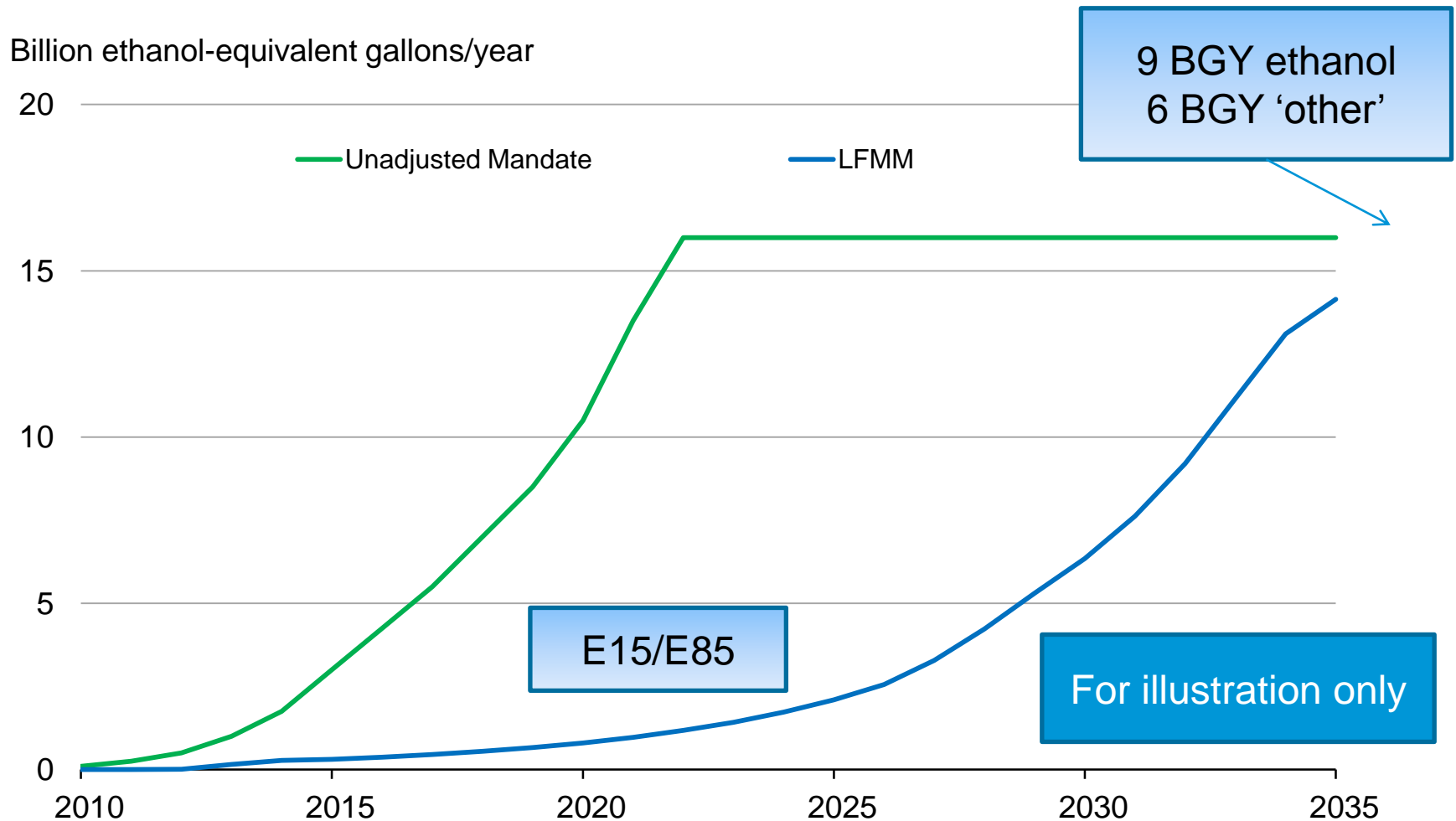
The following slides show sample LFMM run results from May 2012. The results are for illustration and discussion purposes only.

Biomass-based Diesel RFS Credits

Billion ethanol-equivalent gallons/year

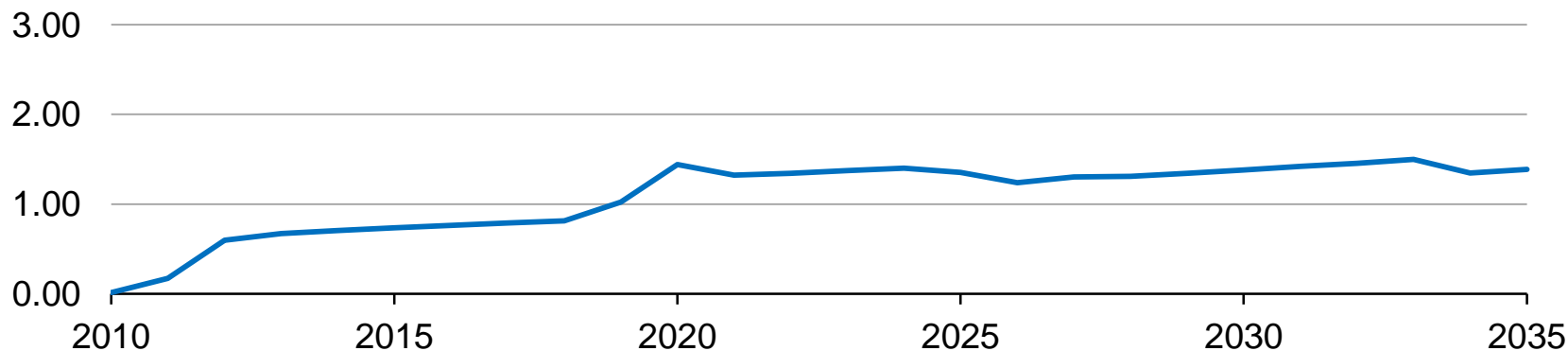


Cellulosic RFS Credits

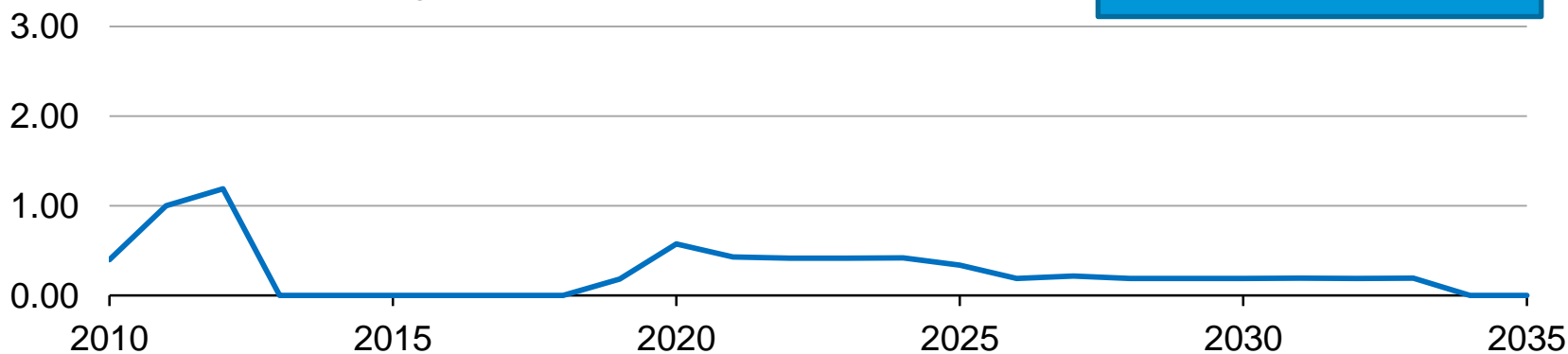


LFMM allows two-way ethanol trade with Brazil

Imports of **sugarcane ethanol** from Brazil
Billion ethanol-equivalent gallons/year



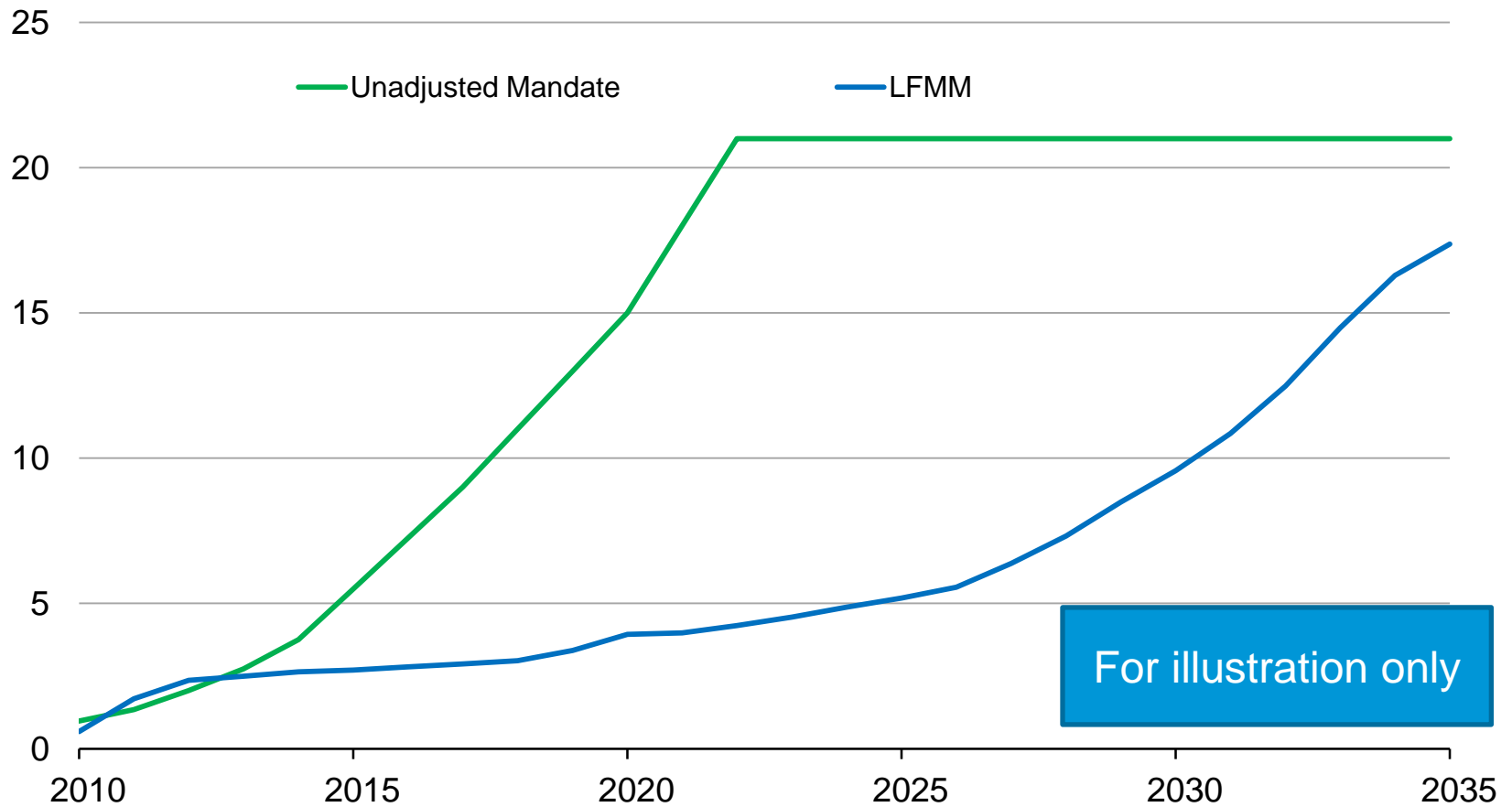
Exports of corn ethanol to Brazil
Billion ethanol-equivalent gallons/year



For illustration only

Advanced RFS Credits

Billion ethanol-equivalent gallons/year



For illustration only

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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