Analysis: The U.S. Renewable Fuel Standard

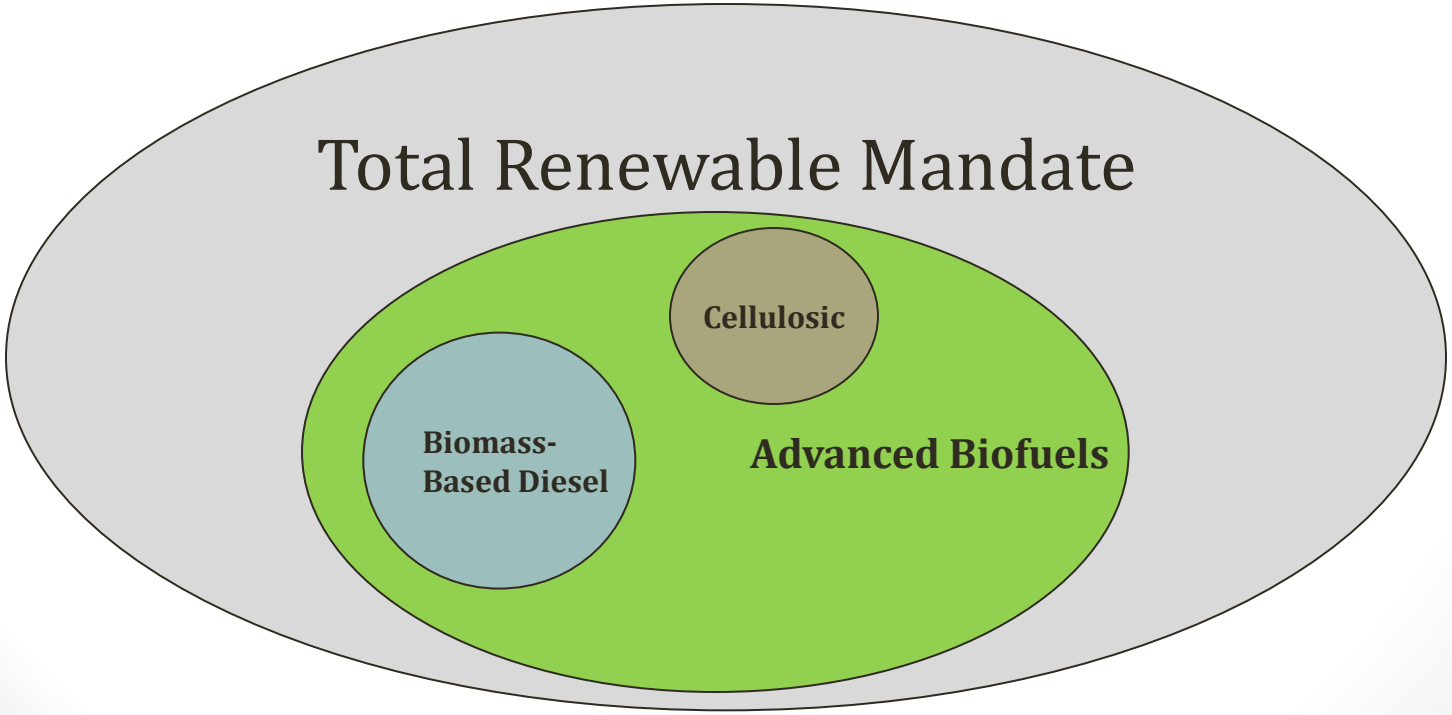
How is it Working?

Background

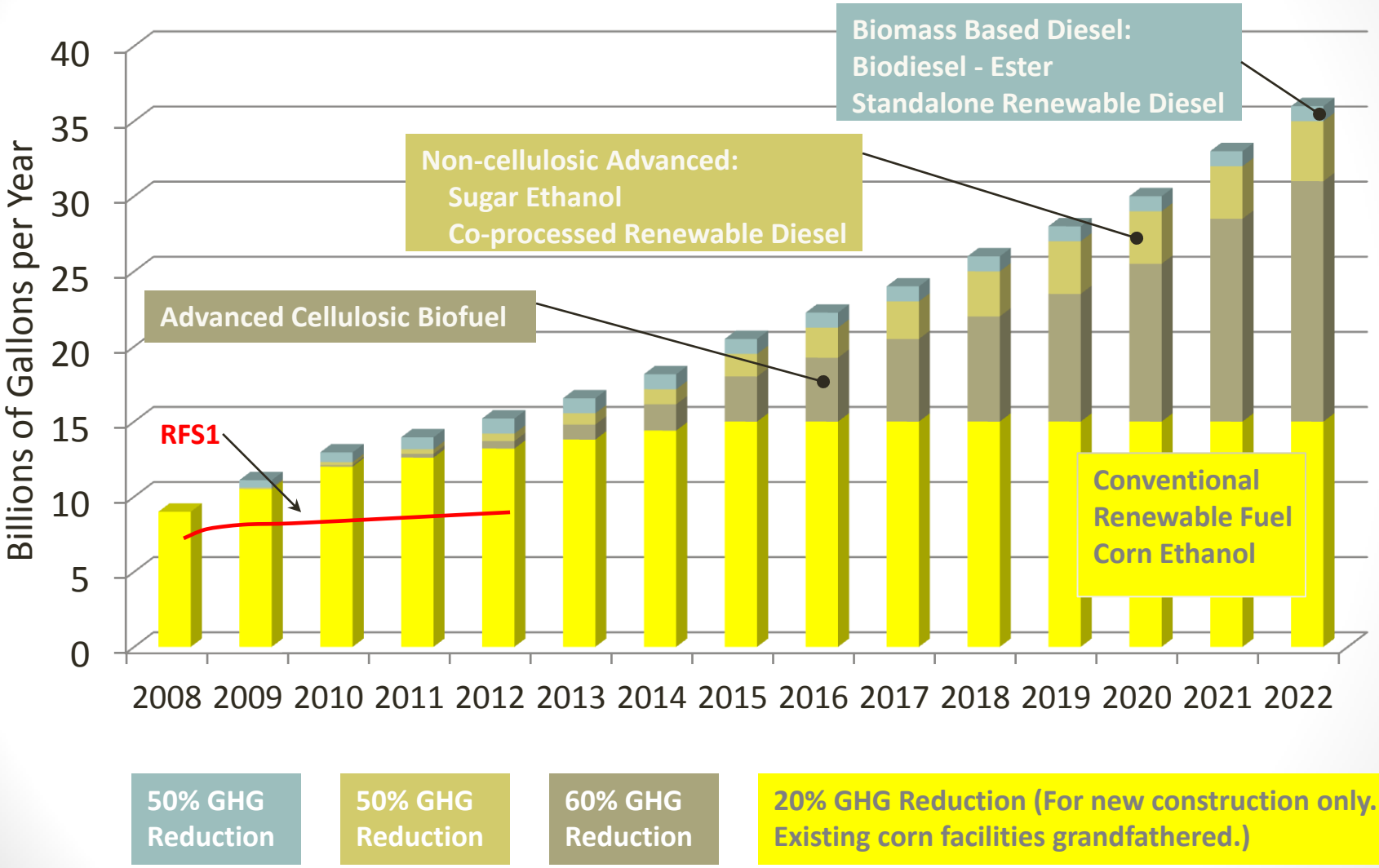
- Energy Independence and Security Act of 2007 (EISA)expands the Renewable Fuel Standard (RFS2)
  - EPA final rule effective July 1, 2010 with full year compliance
  - Biofuel volumes increase significantly in RFS2 vs. RFS1 (mandated in 2005)
- Biofuel producers and importers generate fuel credits, Renewable Identification Numbers (RINs)
  - Petroleum refiners and importers ("obligated parties") acquire sufficient RINs to demonstrate compliance based on the amount of gasoline and diesel they refine and/or import.
- RFS2 is complex: four nested volumetric mandates
  - Total renewable biofuel
  - Advanced biofuel
  - Cellulosic biofuel
  - Biomass based diesel

“Nested” RFS Mandates

- Cellulosic and biomass based diesel are two separate sub-categories “nested” within the advanced biofuels category
- The advanced category is “nested” within the total renewable mandate; the remainder is conventional fuels
- If cellulosic volumes are not available, EPA can issue cellulosic waivers and may also reduce the advanced and total renewable mandate



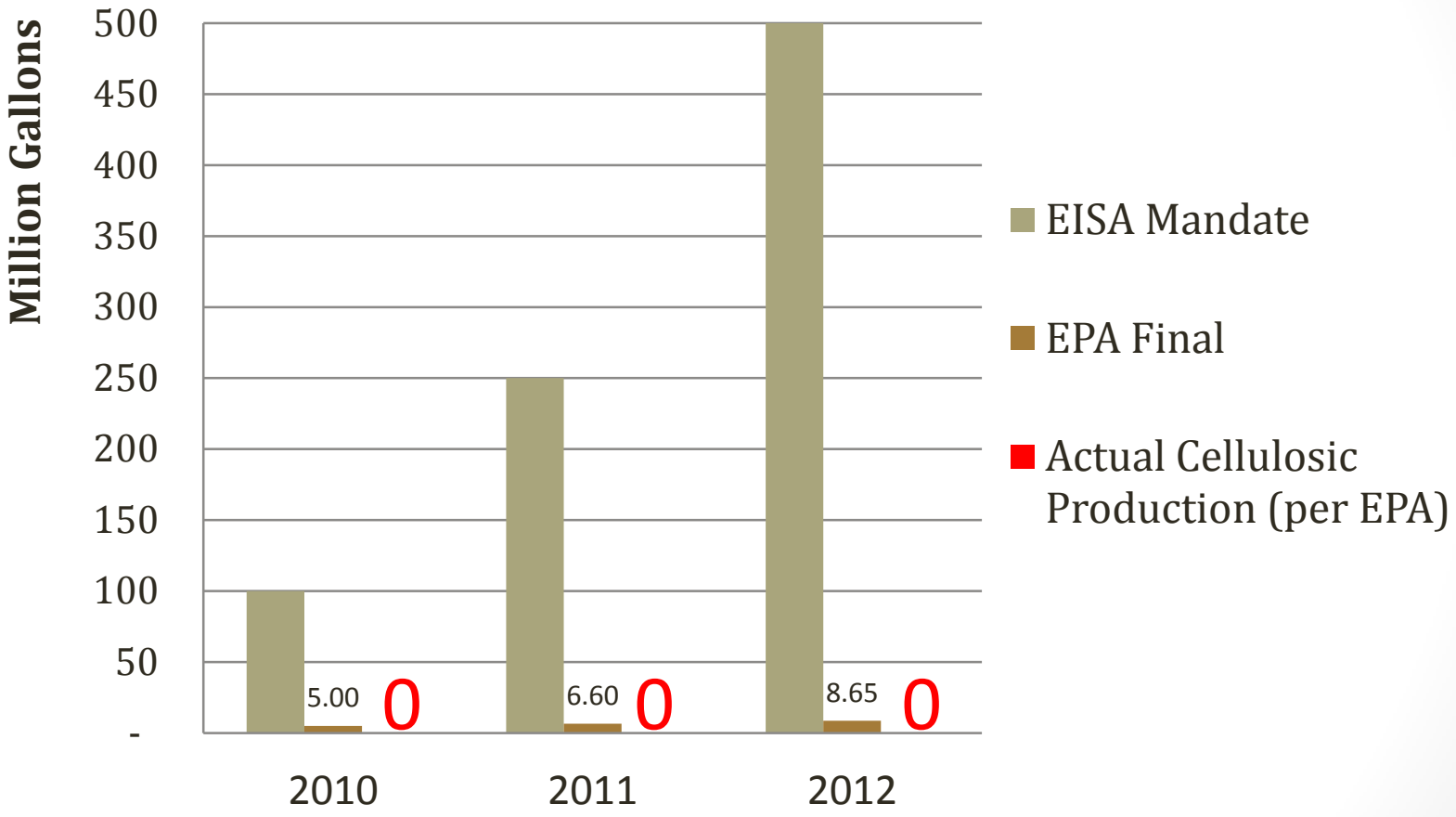
Renewable Fuel Standard



Cellulosic Mandate in Practice

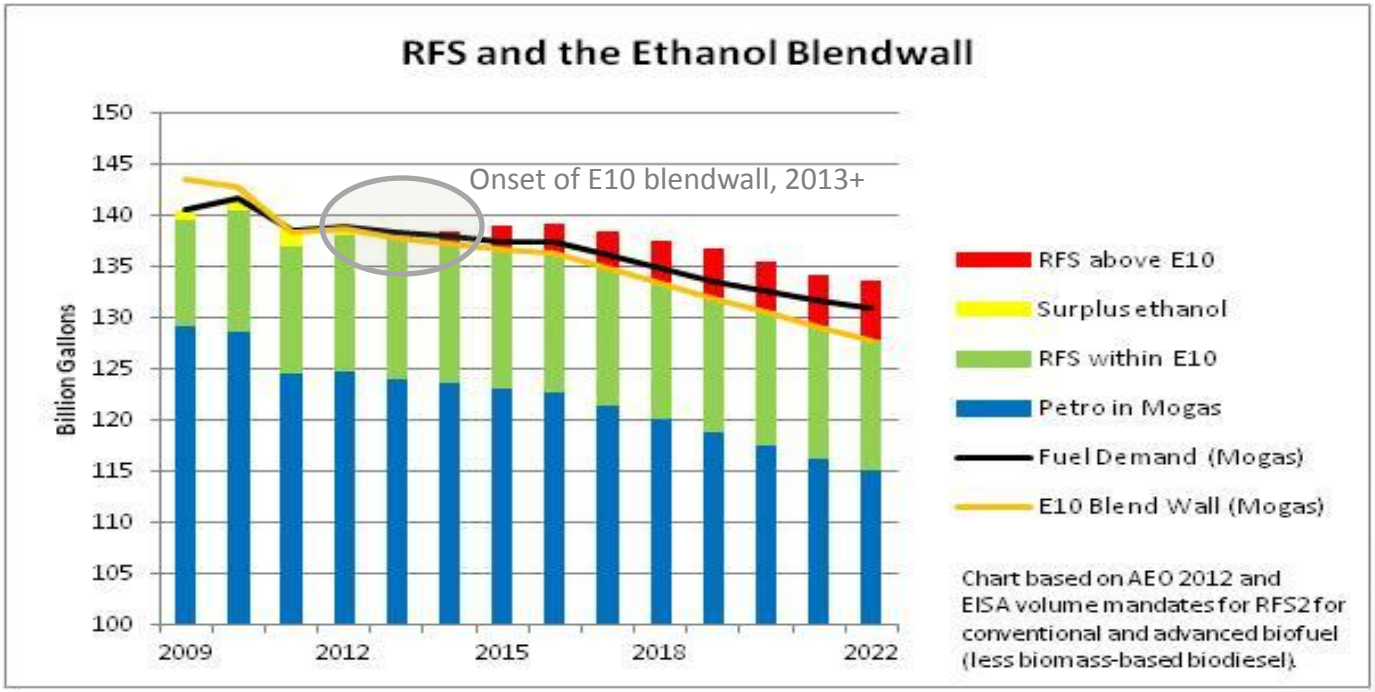
- Each year, EPA is required to set the cellulosic mandate based on EIA data
  - EPA's optimistic assessments "*to help drive the production of volumes that will be made available*" have consistently exceeded EIA's recommendations
- EPA has not exercised its option to reduce the advanced or total renewable mandates in proportion to the cellulosic biofuel waiver
- No commercial cellulosic biofuels have been created to-date
  - Yet, every year, obligated parties *must* purchase cellulosic waiver credits from the EPA in order to comply
    - This equates to a tax for not using a product that does not exist
    - This government imposed fee could harm consumers and does nothing to benefit the environment
- API filed legal challenge on the 2012 cellulosic RFS standard

Cellulosic Mandates vs. Reality



The "E10 Blendwall"

- As biofuel mandates increase, the ethanol volume required for blending into gasoline will exceed 10% – a situation known as the "E10 blendwall"
  - Current vehicles and retail infrastructure have been designed/approved for E10
- Depending on U.S. gasoline demand and individual companies' operations, obligated parties may encounter the "E10 blendwall" as early as 2013, even without the cellulosic mandate
  - Decline in U.S. gasoline demand will accelerate this timing



Solutions to the "E10 Blendwall"

- Gasoline with higher ethanol content
  - E15 (15% ethanol)
  - E85 (85% ethanol)
- Potential reduction of obligated volumes?
  - Potential exports of gasoline, diesel
- Further pressure on refinery economics
  - Loss of outlets for refinery petroleum products

Issues with E15 Fuel

- EPA issued partial waiver for E15 for 2001 and newer light-duty cars and trucks and prohibited the use in other vehicles and engines
- EPA's E15 partial waiver decisions bifurcate the fleet and were premature
  - Vehicle engine durability may be compromised with E15 according to Coordinating Research Council (CRC) tests [1]

Description (All Duplicates)	E20	E15	E0
Vehicle 1	Passed	Not Req'd	Not Req'd
Vehicle 2	Failed	Failed	Passed
Vehicle 3	Failed	Failed	Passed
Vehicle 4	Waived*	Not Req'd	Not Req'd
Vehicle 5	Waived*	Not Req'd	Not Req'd
Vehicle 6	Waived*	Not Req'd	Not Req'd
Vehicle 7	Passed	Not Req'd	Not Req'd
Vehicle 8	Failed	Failed	Failed**

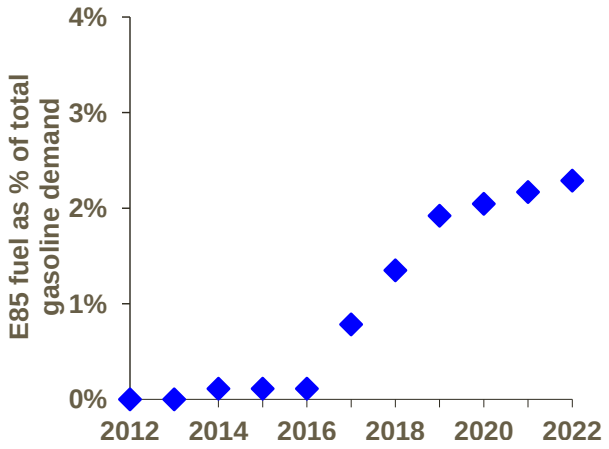
* Waived vehicles did not pass all specified criteria but were not tested on E15 or E0 after a detailed review of the data with the respective OEM and CRC concluded that fuel was not a factor. ** Failure was less severe than on E20 or E15.

  - Automobile manufacturers do not warranty vehicles for E15
  - Retail fueling infrastructure is not designed or certified for E15
    - Studies show over 50% of retail fueling equipment may be E15 incompatible [2]
- Broad coalition has challenged the EPA E15 partial waiver in Court

[1] "Intermediate Level Ethanol Blends Engine Durability Study", April 2012, http://www.crcao.com/reports/recentstudies2012/CM-136-09-1B%20Engine%20Durability/CRC%20CM-136-09-1B%20Final%20Report.pdf

Issues with E85 Fuel

- E85 fuel is allowed for flexible fuel vehicle (FFV) use only
  - About 4% of vehicles in the U.S. today are FFVs
- Low consumer acceptance
  - E85 fuel economy and driving range are reduced by 25-30% vs. gasoline
  - Limited use today and low projected E85 growth according to EIA



Source: EIA 2012 Annual Energy Outlook Early release

- Limited E85 infrastructure
  - Fewer than 2,300 or less than 1.5% of retail outlets nationwide offer E85
  - High installation costs: $25,000 (dispensing equipment) to $200,000+ (tanks)
  - Retailers, most of whom are small business owners, are reluctant to install due to difficulty recouping investments
    - Only 1% of retail outlets owned, operated by major oil companies per GAO 2011 study [1]

[1] GAO, "Biofuels: Challenges to the Transportation, Sale, and use of Intermediate Ethanol blends" (June 2011)

Fraudulent RINs Jeopardize the RFS

- Since November 2011, three biodiesel producers have been indicted for generating 140 million fraudulent RINs
  - 5% of the biomass-based diesel RFS obligation in 2010-2011
- EPA has issued Notices of Violation and imposed fines to obligated parties for using invalid RINs for compliance
- Small biodiesel facilities currently have difficulties marketing RINs
  - 2012 biomass based diesel RFS standard may be in jeopardy
- Fraud issues are limited to biodiesel, but can easily expand
  - Biodiesel RINs have been priced at ~$1.40 vs. ~$0.02 for corn ethanol[1]
  - Other advanced biofuel RINs also command a premium of ~$0.75[1]
  - The E10 blendwall could cause price increases for all RFS categories (including corn ethanol)
- *Regulatory changes needed to ensure RIN validity and provide affirmative defenses, consistent with other fuel and fuel additive regulations*

[1] RIN price information per OPIS; 2012 RINs

The National Academy of Sciences Raises Concerns About the RFS

Recent Academy's Study Findings of RFS Impacts [1]:

- **Environment**
  - RFS may be ineffective policy for reducing GHGs because of land use change impacts
  - For 16 billion gallons per year of cellulosic biofuels, 30-60 million acres of land will be required equivalent to 15 – 30 times the area of Yellowstone National Park
  - Significant quantities of water use, 10 to 200 times higher for biofuels than fossil fuels
  - Decreased air quality and higher pollutant concentrations from biofuel production
  - Soil quality and biodiversity affected from feedstock production and removal

- **Technological Barriers**
  - Absent major technological changes RFS cellulosic standard unlikely to be met in 2022

- **High Costs**
  - Without subsidies, biofuels are economic at crude oil price of 191 $/barrel or alternatively at a carbon price of ~ 120 $/tonne CO2e and crude oil at 111 $/barrel
  - For 16 billion gallons of cellulosic ethanol, 305 new plants needed at a cost of 116 billion $
  - Increased federal spending required (grants, loans, loan guarantees to support the development of cellulosic biofuels and foregone revenue as a result of biofuels tax credits)
    - e.g., E85 / FFV scenario is estimated at 11 billion$ NPV

- **Impact on Food Prices**
  - Food based biofuel is one of the several factors that contributed to upward price pressure on agricultural commodities, food and livestock since 2007.

[1] "Potential Economic and Environmental Effects of U.S. Biofuel Policy", October 2011, http://www.nap.edu/catalog.php?record_id=13105

Food for Fuel? – A Growing Concern

Stanford University, Center for Food Security and the Environment [1]:

- "Policies such as the United States' Renewable Fuels Standard (RFS), which sets a national target of using 15 billion gallons of corn-based ethanol per year by 2015, have reshaped price and supply dynamics in food markets. Because of the substitutability of basic food commodities, prices of corn ripple through all of the world food economy markets and affect demand and supply of wheat, rice and soy. Poor households in the developing world, where 70-80% of the budget is spent on food, will be hurt the most."

World Bank Research and Modeling Results [2]:

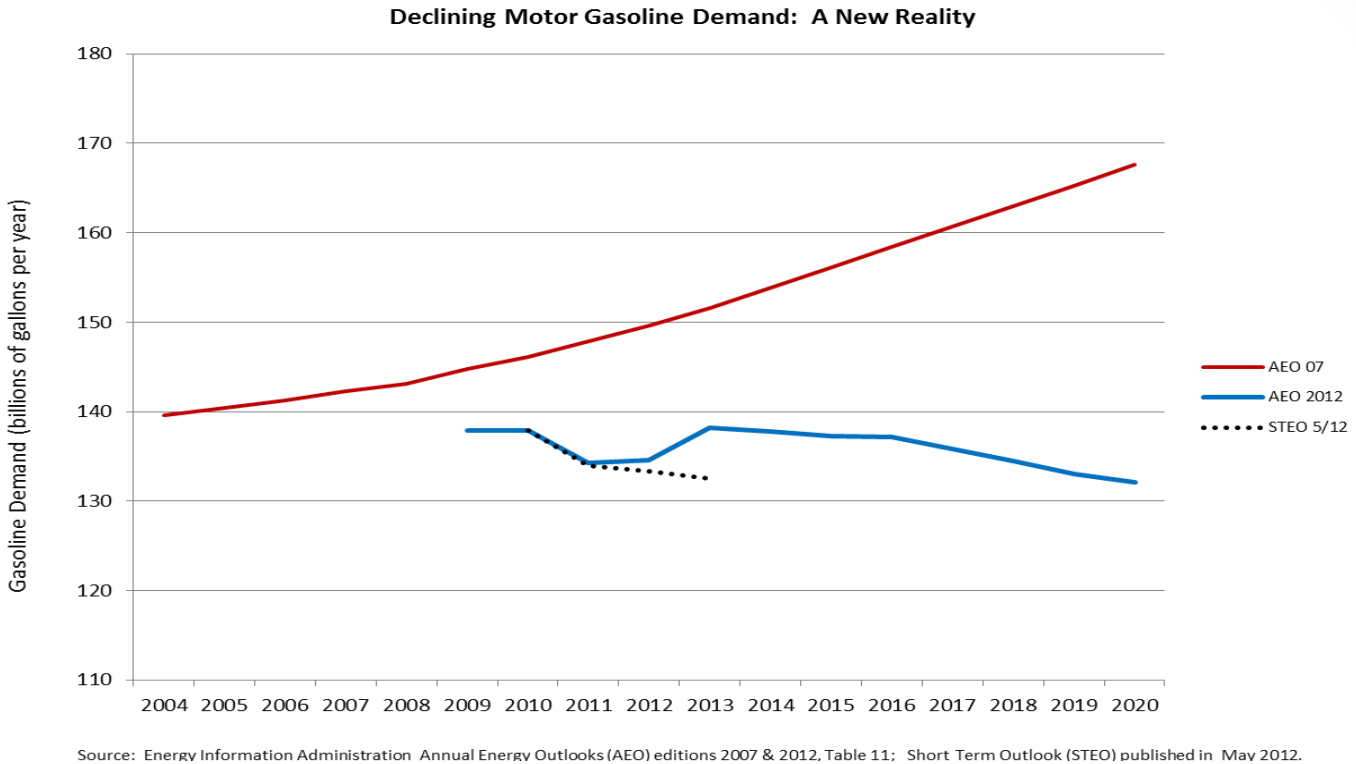
- Expanding biofuel production in the next decade could increase global prices for corn and other major grains by as much as 3% and the price of sugar by 8%. Poor people in some developing countries would find it harder to afford an adequate diet.

Food and Agriculture Organization of the United Nations [3]:

- Expected 70% increase in global food demand to 2050, doubled in developing countries
- Growing biofuels market is a new source of demand, impacting food markets through related land use changes

[1] http://foodsecurity.stanford.edu/news/biofuels_have_mixed_impacts_on_food_security_20120419/
[2] http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/0,,contentMDK:22946809~pagePK:64165401~piPK:64165026~theSitePK:469372,00.html
[3] http://www.agri-outlook.org/dataoecd/13/13/45438527.pdf

Challenges Unforeseen at Inception



Source: Energy Information Administration Annual Energy Outlooks (AEO) editions 2007 & 2012, Table 11; Short Term Outlook (STEO) published in May 2012.

- Biofuel requirements were based on significantly greater gasoline demand projections
  - EIA's 2012 outlook for 2022 projects 25% lower demand vs. the 2007 outlook when current mandates were set
- Cellulosic technologies were expected to develop within a few years
  - Seven years later, still no commercial production to-date
- E10 Blendwall and E85 issues not fully comprehended at the time
  - Significant infrastructure and cost challenges

Conclusions - An Unworkable Mandate

- E10 Blendwall
- Vehicle and infrastructure cost and consumer safety issues with E15
- Lack of E85 fuel acceptance by consumers and high infrastructure costs
- Fraudulent RINs could put entire biofuels program in jeopardy
- No commercial cellulosic biofuel production to-date
- Uncertain lifecycle environmental benefits for biofuels per National Academy of Sciences
- Food for fuel a growing concern