

Cellulosic Biofuels in FAPRI Baseline of 2013

Jarrett Whistance
EIA Biofuels Workshop
20 March 2013

Food and Agricultural
Policy Research Institute



Who we are

- Food and Agricultural Policy Research Institute at the University of Missouri (FAPRI-MU)
 - Objective policy analysis
 - Focus on how policies affect decisions, then estimate market impacts
- Recently released annual baseline
 - 10-year projection of agricultural and biofuel markets
 - Stochastic process to account for different assumptions in oil price, weather patterns, etc.

Outline

- Cellulosic model basics
- Key assumptions in the biofuel model
 - Focus on cellulosic waiver options
- Implications of cellulosic waiver options
- A look at the 2013 Baseline results

Cellulosic model basics

- Cellulosic biofuel production based on supply of five feedstocks:
 - Warm-season grasses; Wheat straw; Corn stover; Forest material; Municipal solid waste
 - Feedstock supply estimates based on parameters from a meta-analysis performed, in part, by Wyatt Thompson

- Technological improvement is assumed
 - Yields
 - Other operating costs
- Some capacity for competition with renewable electricity providers
- Linked to rest of FAPRI model through crop returns and crop area effects

Key assumptions

- Account for extension of biodiesel blender and cellulosic producer tax credits
 - Assume they expire at the end of 2013
- Assume biomass-based diesel requirement beyond 2013 remains at 1.28 billion gallons

- Assume EPA continues to adjust cellulosic requirement down from original EISA levels
 - Cellulosic biofuel production falls short of intended targets
 - Cellulosic requirements reset to levels of actual production
 - We assume EPA opts to waive broader mandates (overall and advanced) by cellulosic shortfall beginning in 2014

Cellulosic waiver 2013

(billion gallons)	EISA	Proposed by EPA	Difference
Overall mandate	16.55	16.55	0
Advanced	2.75	2.75	0
Biodiesel	Not stated	1.28	n.a.
Cellulosic	1.000	0.014	-0.986
Conventional gap (corn starch ethanol)	13.80 (16.55-2.75)	13.80 (16.55-2.75)	0
Advanced gap (sugar cane ethanol imports)	Unknown	0.816 (2.75-1.28*1.5-0.014)	+0.816 ?

Cellulosic waiver options

(billion gallons)	2012	2013	2015	2022
Cellulosic mandate	0.5	1.0	3.0	16.0
Cellulosic production	Almost zero	?	?	?
Difference	0.5	Up to 1.0	Up to 3.0	Up to 16.0

Options:

1. Lower advanced and overall mandates. (*Baseline*)
→ **Gaps remain at EISA levels**
2. Leave broader mandates unchanged. (*FAPRI-MU Report #04-12*)
→ **Advanced gap ↑**
3. Lower advanced mandate only.
→ **Conventional gap ↑**

Market Impacts of Cellulosic Mandate Waiver Options

FAPRI-MU Report #04-12, July 2012

- Based on 2012 FAPRI-MU baseline
- Compare EPA options for cellulosic waiver
 - Market impacts through 2015/16 marketing year

Cellulosic waiver options

FAPRI-MU Report #04-12, July 2012

(billion gallons)	2012/13	2013/14	2014/15	2015/16
Baseline				
Total	16.1	17.1	18.2	18.5
Advanced	2.5	2.9	3.4	3.5
Cellulosic	0.0	0.2	0.4	0.4
Advanced gap	<u>0.7</u>	<u>0.8</u>	<u>1.1</u>	<u>1.2</u>
Conventional gap	13.6	14.2	14.8	15
Unwaived				
Total	16.1	17.6	19.7	21.7
Advanced	2.5	3.4	4.9	6.7
Cellulosic	0.0	0.2	0.5	0.8
Advanced gap	<u>0.7</u>	<u>1.3</u>	<u>2.5</u>	<u>3.9</u>
Conventional gap	13.6	14.2	14.8	15

Market Impacts of Cellulosic Mandate Waiver Options

FAPRI-MU Report #04-12, July 2012

- Compare EPA options for cellulosic waiver
 - Market impacts through 2015/16 marketing year
- If ethanol use requirement increases, then
 - Implied retail ethanol price falls to encourage use
 - Greater likelihood that biodiesel exceeds mandate
- Ethanol imports & exports interact
- Compliance cost impacts

Compliance cost effects

FAPRI-MU Report #04-12, July 2012

	2013/14	2014/15	2015/16
Baseline			
Conventional (\$/RIN)	0.42	0.76	0.67
Advanced (\$/RIN)	0.95	1.10	0.91
Biomass-based diesel (\$/RIN)	1.99	1.87	1.79
Total compliance cost (billion \$)	<u>10.52</u>	<u>16.50</u>	<u>15.19</u>
Unwaived			
Conventional (\$/RIN)	0.48	0.94	0.90
Advanced (\$/RIN)	1.09	1.39	1.42
Biomass-based diesel (\$/RIN)	1.99	1.89	1.85
Total compliance cost (billion \$)	<u>11.86</u>	<u>21.82</u>	<u>24.19</u>

New FAPRI-MU Baseline

- U.S. Baseline Briefing Book released two weeks ago (www.fapri.missouri.edu)
- Biofuels Baseline released last week (www.fapri.missouri.edu)
- Highlights
 - Moderate pace of cellulosic biofuel production
 - Slow growth in cellulosic diesel

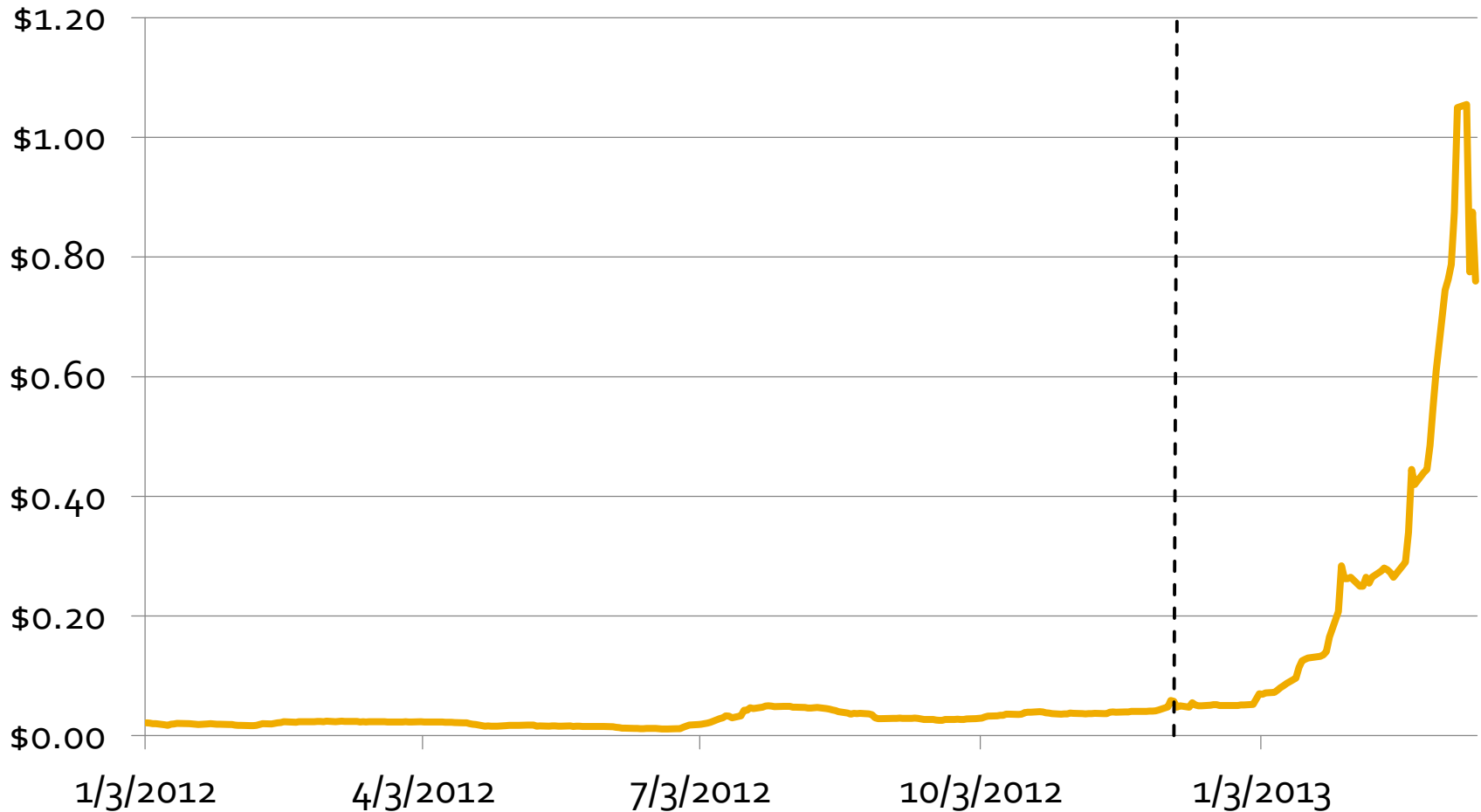
New FAPRI-MU Baseline

Biomass feedstock and cellulosic biofuel supplies

Marketing year	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
(million dry tons)											
Supplies for liquid fuels											
Warm season grasses	0.0	0.0	0.2	0.3	1.3	3.2	5.3	7.4	9.5	11.5	14.1
Wheat straw	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest matter	0.2	0.3	0.8	1.2	2.1	3.6	5.4	6.5	7.3	8.1	9.4
Corn stover	0.0	0.0	0.3	0.5	1.6	2.8	4.1	5.2	6.1	6.9	7.8
Municipal waste	0.1	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
Total	0.3	0.5	1.6	2.6	5.8	10.6	15.9	20.4	24.5	28.3	33.2
(million gallons)											
Supplies of liquid fuels											
Warm season grasses	1	2	17	30	115	275	461	645	833	1015	1250
Wheat straw	0	0	0	0	0	0	0	0	0	0	0
Forest matter	13	20	53	89	152	260	388	473	537	600	697
Corn stover	1	3	24	35	117	215	314	400	471	536	613
Municipal waste	7	16	33	52	70	89	109	128	147	167	187
Total	21	40	126	204	455	840	1271	1646	1988	2318	2747
Cellulosic ethanol	9	21	98	173	421	803	1,231	1,603	1,942	2,269	2,695
Cellulosic diesel	13	20	28	31	34	37	40	43	46	49	52
(Dollars per gallon)											
Ethanol prices											
Conventional rack, Omaha	2.33	2.04	2.02	2.08	2.11	2.13	2.15	2.19	2.20	2.19	2.21
Cellulosic rack	3.92	3.19	3.31	3.43	3.53	3.63	3.69	3.68	3.69	3.72	3.74

Source: Whistance and Thompson, "FAPRI-MU Biofuel Baseline", FAPRI-MU Report #02-13, March 2013.

Conventional RIN prices 2012 and 2013



Note: price data in 2012 are for 2012 vintage RINs and price data in 2013 are for 2013 vintage RINs.

Source: Oil Price Information Service (OPIS).

Reason for higher conventional RIN price?

- Drought
 - Lower profitability → Idle capacity → More competition for RINs to show compliance
- Blend wall
 - Mandate exceeds 10% motor gasoline use → More competition for RINs to show compliance

Mandates more binding in future?

Higher RIN prices indicate more binding mandates

- Mandates are growing
 - Cellulosic waiver?
- Blend wall
 - Declining motor fuel consumption
- Risk of other shocks
 - Drought persists?

To wrap up

- Our cellulosic biofuel model is ***not*** intended to predict “winners” and “losers” in terms of technology
- Rather, it aims to provide a plausible context within the broader agriculture and biofuel models
- Assumptions play a pivotal role in our projections