

**TLU 1 - DEVELOP AND EXPAND LOW GHG FUELS
CALCULATION SUMMARY**

TLU 1a

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline I&F																					
On-road gas GHGs (MMtCO2e)	76.22	78.57	80.99	83.48	86.05	88.70	91.13	93.62	96.18	98.80	101.50	103.94	106.44	109.00	111.62	114.30	116.68	119.10	121.57	124.10	126.68
On-road diesel GHGs (MMtCO2e)	18.28	19.22	20.21	21.24	22.33	23.48	24.47	25.49	26.56	27.68	28.84	29.87	30.93	32.04	33.18	34.37	35.55	36.78	38.05	39.36	40.72
Baseline ethanol %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Baseline biodiesel %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Recent Actions																					
Ethanol mandate						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Impact of ethanol mandate (MMtCO2e)						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biodiesel mandate						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Impact of biodiesel mandate (MMtCO2e)						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Ethanol %						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Biodiesel %						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alternative Fuel Development and Expansion																					
Ethanol %						2%	4%	6%	8%	9%	11%	13%	15%	17%	19%	21%	23%	24%	26%	28%	30%
Cellulosic market share (% of ethanol)						2%	3%	3%	4%	4%	5%	5%	6%	6%	7%	7%	8%	8%	9%	9%	10%
Composite GHG % reduction from policy						14%	15%	15%	15%	15%	16%	16%	17%	17%	18%	18%	19%	19%	20%	20%	21%
GHG reduction (MMtCO2e)						0.257	0.511	0.780	1.064	1.363	1.819	2.240	2.700	3.202	3.749	4.343	4.970	5.645	6.370	7.148	7.980
Ethanol credit attributable to policy (MMtCO2e)						0.257	0.511	0.780	1.064	1.363	1.819	2.240	2.700	3.202	3.749	4.343	4.970	5.645	6.370	7.148	7.980
Biodiesel %						2%	3%	3%	4%	4%	5%	5%	6%	6%	7%	7%	8%	8%	9%	9%	10%
GHG reduction (MMtCO2e)						0.416	0.549	0.692	0.846	1.012	1.191	1.375	1.570	1.777	1.997	2.231	2.475	2.734	3.008	3.298	3.603
Biodiesel credit attributable to policy (MMtCO2e)						0.416	0.549	0.692	0.846	1.012	1.191	1.375	1.570	1.777	1.997	2.231	2.475	2.734	3.008	3.298	3.603
Reduction in Average Fuel Carbon Intensity (AFCI)						0.6%	0.9%	1.2%	1.6%	1.9%	2.3%	2.7%	3.1%	3.5%	4.0%	4.4%	4.9%	5.4%	5.9%	6.4%	6.9%
Total credit attributable to policy (MMtCO2e)						0.673	1.060	1.472	1.910	2.376	3.010	3.814	4.270	4.979	5.746	6.573	7.445	8.379	9.378	10.445	11.584

Cumulative (2008-2025)
82.914

TLU 1a - Assumptions

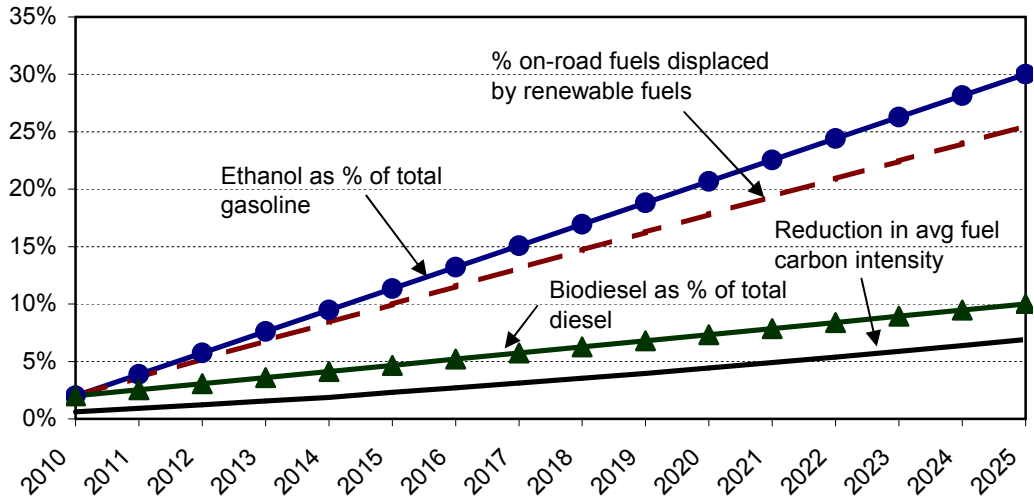
ethanol % @2010	2%
ethanol % @2025	30%
cellulosic ethanol market share @2015	2%
cellulosic ethanol market share @2025	10%
E85 (FFV) market share @2010 (% of ethanol)	2%
E85 (FFV) market share @2025 (% of ethanol)	10%
biodiesel % @2010	2%
biodiesel % @2025	10%
biodiesel feedstock/blend	B20 soy
% on-road fuels displaced by alt fuels @2025	25.49% (goal: 25%)
% reduction in AFCl @ 2020	4.42%
% reduction in AFCl @ 2025	6.92%

TLU 1a - Reduction Factors

Fuel/Technology	Blend	Feedstock	Reduction (grams of GHGs per mile)	Normalized Reduction (100% blend)	Source
Ethanol	E10	corn	1.4%	14.4%	GREET v1.8
Ethanol	E10	sugarcane	4.6%	46.1%	GREET v1.8
Ethanol	E10	cellulosic	7.4%	74.1%	GREET v1.8
Ethanol	E85	corn	15.9%	18.7%	GREET v1.8
Ethanol	E85	sugarcane	51.7%	60.8%	GREET v1.8
Ethanol	E85	cellulosic	83.8%	98.6%	GREET v1.8
Biodiesel	B20	soy	17.7%	88.5%	GREET v1.8

TLU 1a - Assumptions

Year	E85 Ethanol Market	E10 Ethanol Market	% Ethanol in Gasoline	Ethanol Feedstocks		% Biodiesel in Diesel	% Renewable Fuels
				% Corn	% Cellulosic		
2010	2%	98%	2%	100%	0%	2%	2%
2015	5%	95%	11%	98%	2%	5%	10%
2025	10%	90%	30%	90%	10%	10%	25%



TLU 1a - Cost Factors

Fuel Energy (gallons/MMBtu)	
Ethanol	11.90
Biodiesel	8.50
Gasoline	8.00
Diesel	7.21

Discount Rate	5%
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Assumed Cost Differential (cents per gallon)	
Biodiesel, current year	59.00

Source: U.S. DOE Alternative Fuels Price Report, Apr 2008 (avg price of B99 - avg price of diesel, Lower Atlantic)

Incremental Fuel Cost (cents per gallon)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Ethanol E85						-31.74	-38.69	-20.87	-32.84	-52.64	-58.33	-52.07	-63.63	-64.55	-53.93	-63.30	-68.23	-65.57	-60.74	-56.08	-60.46
Biodiesel B99						59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00

TLU 1a - Cost

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Gallons of Gasoline (million)	8646.813	8913.075	9187.541	9470.465	9762.106	10062.73	10337.73	10620.25	10910.49	11208.66	11514.98	11791.68	12075.0355	12365.19532	12662.32789	12966.60078	13235.94412	13510.88259	13791.53242	14078.01227	14370.44324
Baseline Gallons of Diesel (million)	1876.949	1973.247	2074.486	2180.919	2292.813	2410.447	2511.585	2616.967	2726.77	2841.181	2960.393	3066.122	3175.627467	3289.044123	3406.511682	3528.174845	3649.809178	3775.637438	3905.80427	4040.459312	4179.757367
Baseline Gallons of Gasoline+Diesel (million)	10523.76	10886.32	11262.03	11651.38	12054.92	12473.18	12849.32	13237.22	13637.26	14049.84	14475.38	14857.81	15250.66296	15654.23944	16068.83957	16494.77562	16885.7533	17286.52003	17697.33669	18118.47158	18550.20061
Attributable to LCFS																					
Ethanol (million gallons gasoline equivalent)						201.2547	399.7257	608.8943	829.1971	1061.087	1305.031	1556.502	1819.305348	2093.83974	2380.517643	2679.76416	2982.499408	3296.655352	3622.675849	3960.614118	4311.132973
Biodiesel (million gallons diesel equivalent)						48.20894	63.62682	80.25365	98.16374	117.4355	138.1517	159.4383	182.0693081	206.1134317	231.6427944	258.732822	287.118322	317.1535448	348.9185147	382.4968149	417.9757367
Total Alt Fuels (million gallons)						249.4636	463.3525	689.148	927.3608	1178.522	1443.183	1715.941	2001.374656	2299.953172	2612.160437	2938.496982	3269.61773	3613.808896	3971.494364	4343.110933	4729.10871
Alt Fuels % of Total On-Road Fuels (million gallons)						2.0%	3.6%	5.2%	6.8%	8.4%	10.0%	11.5%	13.1%	14.7%	16.3%	17.8%	19.4%	20.9%	22.4%	24.0%	25.5%
Ethanol (million gallons E85 (avg 74% ethanol))						273.9839	544.1781	828.9359	1128.852	1444.541	1776.642	2118.99	2476.764095	2850.509452	3240.786728	3648.174653	4060.312062	4487.997366	4931.698687	5391.896887	5869.085896
Biodiesel (million gallons B99)						56.74579	74.89388	94.465	115.5466	138.231	162.6156	187.6717	214.3102062	242.6120718	272.6621831	304.5493225	337.961337	373.3152077	410.70513	450.2294874	491.9910294
Total Cost (million \$)						\$ (53.48)	\$ (166.33)	\$ (117.29)	\$ (302.49)	\$ (678.78)	\$ (940.46)	\$ (992.55)	\$ (1,449.49)	\$ (1,696.80)	\$ (1,587.01)	\$ (2,129.53)	\$ (2,571.11)	\$ (2,722.72)	\$ (2,753.09)	\$ (2,758.05)	\$ (3,258.46)
NPV (million \$)						\$ (48.51)	\$ (143.69)	\$ (96.49)	\$ (237.01)	\$ (506.51)	\$ (668.37)	\$ (671.80)	\$ (934.35)	\$ (1,041.69)	\$ (927.89)	\$ (1,185.80)	\$ (1,363.51)	\$ (1,375.16)	\$ (1,324.28)	\$ (1,263.49)	\$ (1,421.66)

NPV (2008-2020)

\$/MTC02e (\$159.32)

TLU 1a - Analysis Results

	2017	2025	Units
GHG Emission Savings	4.27	11.58	MMtCO ₂ e
Net Present Value (2008-2025)		(\$13,210)	\$ Million
Cumulative Reductions (2008-2025)		82.91	MMtCO ₂ e
Cost-Effectiveness		(\$159)	\$/MtCO ₂ e
Gallons saved	2,001	4,729	million gallons
Gallons saved (2009-2025)		36,446	million gallons

TLU 1b

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Baseline I&F																						
On-road gas GHGs (MMtCO2e)	76.22	78.57	80.99	83.48	86.05	88.70	91.13	93.62	96.18	98.80	101.50	103.94	106.44	109.00	111.62	114.30	116.68	119.10	121.57	124.10	126.68	
On-road diesel GHGs (MMtCO2e)	18.28	19.22	20.21	21.24	22.33	23.48	24.47	25.49	26.56	27.68	28.84	29.87	30.93	32.04	33.18	34.37	35.55	36.78	38.05	39.36	40.72	
Baseline ethanol %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Baseline biodiesel %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Recent Actions																						
Ethanol mandate						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Impact of ethanol mandate (MMtCO2e)						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biodiesel mandate						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Impact of biodiesel mandate (MMtCO2e)						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Ethanol %						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Total Biodiesel %						0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Alternative Fuel Development and Expansion																						
Ethanol mix %						100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Ethanol % volume content						0%	3%	3%	3%	3%	3%	10%	10%	10%	10%	10%	17%	17%	17%	17%	17%	
Sugarcane market share (% of ethanol)						10%	12%	12%	12%	12%	12%	18%	18%	18%	18%	18%	23%	23%	23%	23%	23%	
Cellulosic market share (% of ethanol)						5%	10%	10%	10%	10%	10%	15%	15%	15%	15%	15%	20%	20%	20%	20%	20%	
Composite GHG % reduction from policy						0%	0%	0%	0%	0%	0%	10%	10%	10%	10%	10%	15%	15%	15%	15%	15%	
GHG reduction (MMtCO2e)						1.418	1.979	2.033	2.089	2.146	2.205	4.713	4.827	4.943	5.061	5.183	8.307	8.479	8.655	8.835	9.019	
Ethanol credit attributable to policy (MMtCO2e)						1.418	1.979	2.033	2.089	2.146	2.205	4.713	4.827	4.943	5.061	5.183	8.307	8.479	8.655	8.835	9.019	
Biodiesel %						1%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	10%	10%	10%	10%	10%	
GHG reduction (MMtCO2e)						0.208	0.433	0.451	0.470	0.490	0.510	1.322	1.369	1.418	1.468	1.521	3.147	3.255	3.367	3.483	3.603	
Biodiesel credit attributable to policy (MMtCO2e)						0.208	0.433	0.451	0.470	0.490	0.510	1.322	1.369	1.418	1.468	1.521	3.147	3.255	3.367	3.483	3.603	
Reduction in Average Fuel Carbon Intensity (AFCI)						1.4%	2.1%	2.1%	2.1%	2.1%	2.1%	4.5%	4.5%	4.5%	4.5%	4.5%	7.5%	7.5%	7.5%	7.5%	7.5%	
Total credit attributable to policy (MMtCO2e)						1.626	2.412	2.484	2.559	2.636	2.715	6.035	6.196	6.360	6.530	6.704	11.453	11.734	12.022	12.318	12.622	

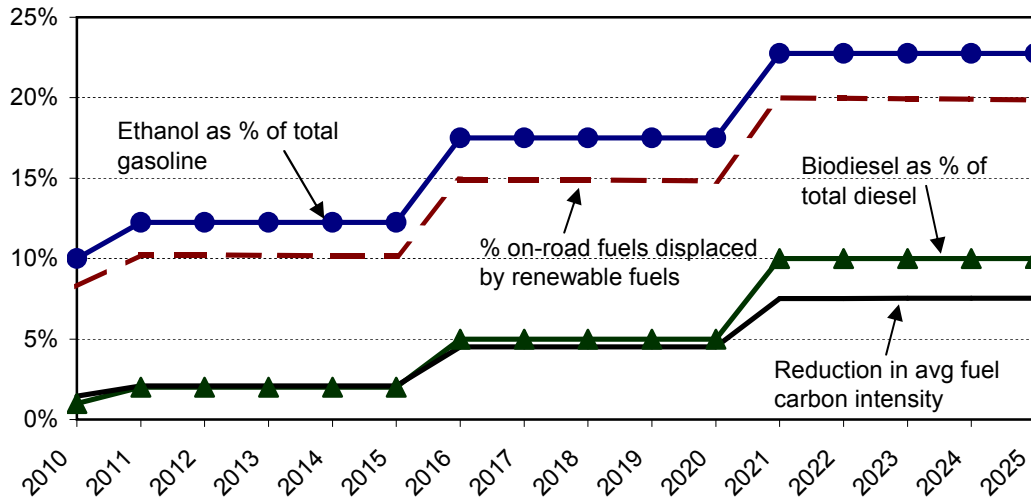
Cumulative (2008-2025)
106.407

TLU 1b - Assumptions

2010	
ethanol mix %	100%
E85 ethanol market share (remainder is E10)	0%
ethanol % volume content	10%
sugarcane ethanol market share	5%
cellulosic ethanol market share	0%
biodiesel (B20) %	1%
biodiesel feedstock/blend	B20 soy
% alt fuels in total on-road fuels	8.3%
% reduction in AFCI	1.4%
2011-2015	
ethanol mix %	100%
E85 ethanol market share (remainder is E10)	3%
ethanol % volume content	12%
sugarcane ethanol market share	10%
cellulosic ethanol market share	0%
biodiesel (B20) %	2%
biodiesel feedstock/blend	B20 soy
% alt fuels in total on-road fuels	10.2%
	2.1%
2016-2020	
ethanol mix %	100%
E85 ethanol market share (remainder is E10)	10%
ethanol % volume content	18%
sugarcane ethanol market share	15%
cellulosic ethanol market share	10%
biodiesel (B20) %	5%
biodiesel feedstock/blend	B20 soy
% alt fuels in total on-road fuels	14.9%
% reduction in AFCI @ 2020	4.5%
2021-2025	
ethanol mix %	100%
E85 ethanol market share (remainder is E10)	17%
ethanol % volume content	23%
sugarcane ethanol market share	20%
cellulosic ethanol market share	15%
biodiesel (B20) %	10%
biodiesel feedstock/blend	B20 soy
% alt fuels in total on-road fuels	20.0%
% reduction in AFCI @ 2025	7.5%

TLU 1b - Assumptions

Time Period	E85 Ethanol Market Share	E10 Ethanol Market Share	% Ethanol in Gasoline	Ethanol Feedstocks			% Biodiesel in Diesel	% Renewable Fuels
				% Corn	% Sugarcane	% Cellulosic		
2010	0%	100%	10%	95%	5%	0%	1%	8%
2011-2015	3%	97%	12%	90%	10%	0%	2%	10%
2016-2020	10%	90%	18%	75%	15%	10%	5%	15%
2021-2025	17%	83%	23%	65%	20%	15%	10%	20%



TLU 1b - Reduction Factors

Fuel/Technology	Blend	Feedstock	Reduction (grams of GHGs per mile)	Normalized Reduction (100% blend)	Source
Ethanol	E10	corn	1.4%	14.4%	GREET v1.8
Ethanol	E10	sugarcane	4.6%	46.1%	GREET v1.8
Ethanol	E10	cellulosic	7.4%	74.1%	GREET v1.8
Ethanol	E85	corn	15.9%	18.7%	GREET v1.8
Ethanol	E85	sugarcane	51.7%	60.8%	GREET v1.8
Ethanol	E85	cellulosic	83.8%	98.6%	GREET v1.8
Biodiesel	B20	soy	17.7%	88.5%	GREET v1.8

TLU 1b - Cost Factors

Fuel Energy (gallons/MMBtu)	
Ethanol	11.90
Biodiesel	8.50
Gasoline	8.00
Diesel	7.21

Discount Rate	5%
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Assumed Cost Differential (cents per gallon)	
Biodiesel, current year	59.00

Source: U.S. DOE Alternative Fuels Price Report, Apr 2008 (avg price of B99 - avg price of diesel, Lower Atlantic)

Incremental Fuel Cost (cents per gallon)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Ethanol E85						-31.74	-38.69	-20.87	-32.84	-52.64	-58.33	-62.07	-63.63	-64.55	-53.93	-63.30	-68.23	-65.57	-60.74	-56.08	-60.46
Biodiesel B99						59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00

TLU 1b - Cost

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Gallons of Gasoline (million)	8646.813	8913.075	9187.541	9470.465	9762.106	10062.73	10337.73	10620.25	10910.49	11208.66	11514.98341	11791.68479	12075.0355	12365.19532	12662.32789	12966.60078	13235.94412	13510.88259	13791.53242	14078.01227	14370.44324
Baseline Gallons of Diesel (million)	1876.949	1973.247	2074.486	2180.919	2292.813	2410.447	2511.585	2616.967	2726.77	2841.181	2960.392837	3066.122002	3175.627467	3289.044123	3406.511682	3528.174845	3649.809178	3775.637438	3905.80427	4040.459312	4179.757367
Baseline Gallons of Gasoline+Diesel (million)	10523.76	10886.32	11262.03	11651.38	12054.92	12473.18	12849.32	13237.22	13637.26	14049.84	14475.37624	14857.80679	15250.66296	15654.23944	16068.83957	16494.77562	16885.7533	17286.52003	17697.33669	18118.47158	18550.20061
Attributable to LCFS	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Ethanol (million gallons gasoline equivalent)						1006.273	1266.372	1300.981	1336.535	1373.061	1410.585467	2063.544838	2113.131212	2163.90918	2215.90738	2269.155136	3011.177287	3073.725789	3137.573626	3202.747791	3269.275838
Biodiesel (million gallons diesel equivalent)						24.10447	50.2317	52.33934	54.53541	56.82363	59.20785673	153.3061001	158.7813734	164.4522062	170.3255841	176.4087423	364.9809178	377.5637438	390.580427	404.0459312	417.9757367
Total Alt Fuels (million gallons)						1030.378	1316.604	1353.32	1391.07	1429.885	1469.793324	2216.850939	2271.912585	2328.361387	2386.232964	2445.563878	3376.158205	3451.289533	3528.154053	3606.793722	3687.251576
Alt Fuels % of Total On-Road Fuels (million gallons)						8.3%	10.2%	10.2%	10.2%	10.2%	10.2%	14.9%	14.9%	14.9%	14.9%	14.8%	20.0%	20.0%	19.9%	19.9%	19.9%
Ethanol (million gallons E85 (avg 74% ethanol))						1369.919	1724.013	1771.128	1819.53	1869.256	1920.341433	2809.266609	2876.772456	2945.900516	3016.689774	3089.18015	4099.353524	4184.505741	4271.426845	4360.153584	4450.723471
Biodiesel (million gallons B99)						28.3729	59.12675	61.60761	64.19256	66.88598	69.69240515	180.4535991	186.8984357	193.5734616	200.4868993	207.6472653	429.6118691	444.4228664	459.7445485	475.594529	491.9910294
Total Cost (million \$)						\$(418.05)	\$(632.07)	\$(333.33)	\$(559.57)	\$(944.42)	\$(1,079.11)	\$(1,356.21)	\$(1,720.18)	\$(1,787.31)	\$(1,508.73)	\$(1,832.87)	\$(2,543.67)	\$(2,481.75)	\$(2,323.12)	\$(2,164.50)	\$(2,400.85)
NPV (million \$)						\$(379.18)	\$(546.01)	\$(274.23)	\$(438.44)	\$(704.74)	\$(766.90)	\$(917.94)	\$(1,108.85)	\$(1,097.25)	\$(882.12)	\$(1,020.61)	\$(1,348.96)	\$(1,253.45)	\$(1,117.46)	\$(991.58)	\$(1,047.48)

\$ (13,895.22)
 \$/Mtc02e (\$130.59)

TLU 1b - Analysis Results

	2017	2025	Units
GHG Emission Savings	6.20	12.62	MMtCO ₂ e
Net Present Value (2008-2025)		(\$13,895)	\$ Million
Cumulative Reductions (2008-2025)		106.41	MMtCO ₂ e
Cost-Effectiveness		(\$131)	\$/MtCO ₂ e
Gallons saved	2,272	3,687	million gallons
Gallons saved (2009-2025)		37,290	million gallons