



“Storage and Distribution Requirements for an Expanded Ethanol Industry”

**Storage and Distribution Requirements
for an
Expanded Ethanol Industry**

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Slide 1 Plants/Production for Case Study B1		
<u>PADD</u>	<u>Number of Plants</u>	<u>Production (mmgy)</u>
I	6	200.0
II	103	4500.0
III	5	200.0
IV	4	12.5
V	11	200.0
Total	129	5,112.5



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Slide 2 Plants/Production for Case Study C		
<u>PADD</u>	<u>Number of Plants</u>	<u>Production (mmgy)</u>
I	31	1400.0
II	144	6600.0
III	28	1100.0
IV	17	400.0
V	21	500.0
Total	129	10,000.0



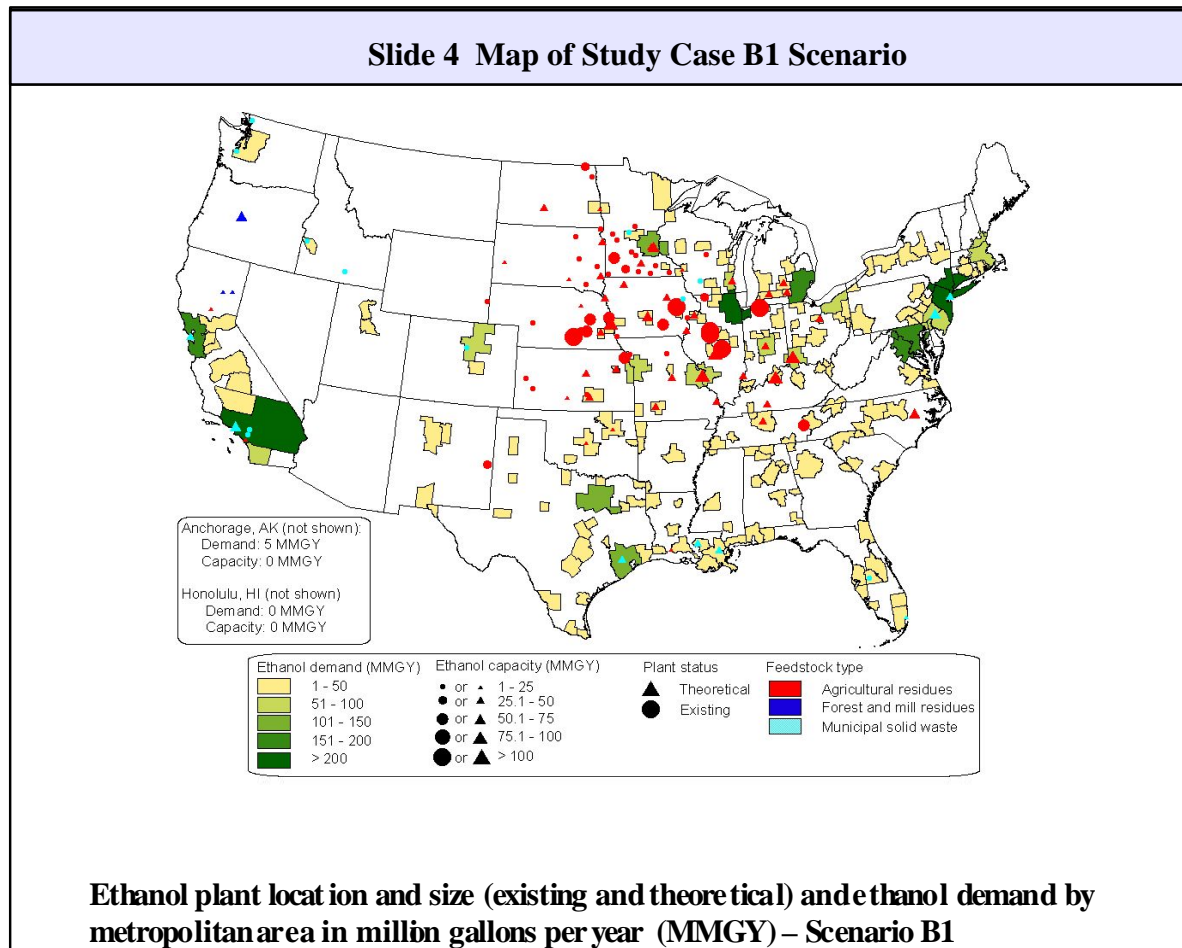
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Slide 3 New Ethanol Volume Used In E10-E5.7 By PADD (bgy)				
<u>PADD</u>	<u>Existing</u>	<u>New Case B1 Volume</u>	<u>New Case C Volume</u>	<u>Total</u>
I	0.098	1.102	1.200	2.400
II	0.928	1.072	1.300	3.300
III	0.074	0.626	1.100	1.800
IV	0.058	0.042	0.300	.400
V [†]	0.655 [†]	0.145	0.600	1.400
Totals [†]	1.813 [†]	2.987	4.500	9.300

† Includes 0.6 bgy used in California that is projected to be in place by the end of 2002.



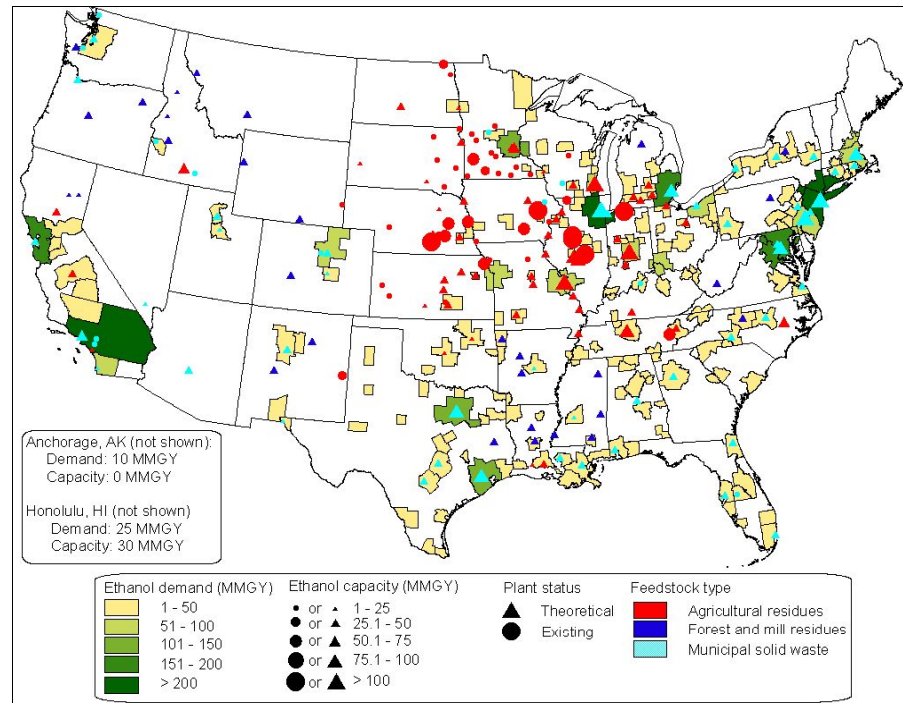
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Slide 5 Map of Study Case C Scenario



Ethanol plant location and size (existing and theoretical) and ethanol demand by metropolitan area in million gallons per year (MMGY) – Scenario C



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Slide 6 Estimated Requirement for New Tanks			
Tanks/Capacity (mbbl)			
<u>PADD</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	45 / 660	87 / 1,137	132 / 1,797
II	74 / 326	88 / 670	162 / 996
III	47 / 388	76 / 590	123 / 978
IV	5 / 50	14 / 80	19 / 130
V	10 / 155	33 / 359	43 / 514
Totals	181 / 1,579	298 / 2,836	479 / 4,415



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Slide 7 Estimated Requirement for Tank Conversions Tanks/Capacity (mbbl)			
<u>PADD</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	18 / 235	7 / 65	25 / 300
II	27 / 86	19 / 120	46 / 206
III	15 / 115	7 / 45	22 / 160
IV	1 / 10	6 / 35	7 / 45
V	2 / 25	5 / 30	7 / 55
Totals	63 / 471	44 / 295	107 / 766



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Slide 8 Estimated Number of Terminals Requiring Blending Equipment by PADD			
<u>PADD</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	81	101	182
II	110	119	229
III	74	91	165
IV	8	26	34
V	14	42	56
Totals	287	379	666



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Slide 9 Estimated Number of Terminals Requiring Rail Spur Installation by PADD			
<u>PADD</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	20	2	22
II	15	10	25
III	10	10	20
IV	3	2	5
V	1	3	4
Totals	49	27	76



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Slide 10 Retail Outlet Profile				
<u>PADD</u>	<u>Existing</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	980	11,020	12,000	24,000
II	10,919	12,611	20,470	44,000
III	1,058	8,942	20,000	30,000
IV	725	525	3,750	5,000
V†	9,234†	2,116	5,308	16,658
Totals	22,916†	35,214	61,528	119,658

† Includes California facilities to be converted by 2003.



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Slide 11 Terminal & Retail Level Expenses for E10/E5.7 by PADD			
<u>PADD</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	\$48,656,800	\$55,265,000	\$103,921,800
II	\$53,489,490	\$63,792,890	\$117,282,380
III	\$38,340,780	\$53,035,000	\$91,375,780
IV	\$4,664,750	\$12,482,500	\$17,147,250
V	\$8,423,440	\$22,776,720	\$31,200,160
Totals	\$153,575,260	\$207,352,110	\$360,927,370

**Slide 12 Case B1 + Case C - Total Estimated Capital Investment for Terminal Improvements
& Retail Conversions for E-10/E-5.7**

	New ethanol Volume Cost per (bgy)	Cost of New Tanks	Cost of Tank Conversion	Cost of Blending Systems	Modification for	Contingency Rail Receipt	Retail	Total Conversions	Amortized Gallon
PADD I									
Case B1	1.102	\$8,850,000	\$645,000	\$24,300,000	\$7,100,000	\$1,260,000	\$6,501,800	\$48,656,800	\$0.0069
Case C	1.200	\$15,115,000	\$180,000	\$30,300,000	\$710,000	\$1,880,000	\$7,080,000	\$55,265,000	\$0.0072
I Total	2.302	\$23,965,000	\$825,000	\$54,600,000	\$7,810,000	\$3,140,000	\$13,581,800	\$103,921,800	\$0.0070
PADD II									
Case B1	1.072	\$5,395,000	\$309,000	\$33,000,000	\$5,325,000	\$2,020,000	\$7,440,490	\$53,489,490	\$0.0078
Case C	1.300	\$9,950,000	\$375,000	\$35,700,000	\$3,550,000	\$2,140,000	\$12,077,890	\$63,792,890	\$0.0077
II Total	2.372	\$15,345,000	\$684,000	\$68,700,000	\$8,875,000	\$4,160,000	\$19,518,380	\$117,282,380	\$0.0077
PADD III									
Case B1	0.626	\$5,735,000	\$340,000	\$22,200,000	\$3,550,000	\$1,240,000	\$5,275,780	\$38,340,780	\$0.0096
Case C	1.100	\$8,600,000	\$125,000	\$27,300,000	\$3,550,000	\$1,660,000	\$11,800,000	\$53,035,000	\$0.0075
III Total	1.726	\$14,335,000	\$465,000	\$49,500,000	\$7,100,000	\$2,900,000	\$17,075,780	\$91,375,780	\$0.0083
PADD IV									
Case B1	0.042	\$750,000	\$20,000	\$2,400,000	\$1,065,000	\$120,000	\$309,750	\$4,664,750	\$0.0173
Case C	0.300	\$1,250,000	\$110,000	\$7,800,000	\$710,000	\$400,000	\$2,212,500	\$12,482,500	\$0.0065
IV Total	0.342	\$2,000,000	\$130,000	\$10,200,000	\$1,775,000	\$520,000	\$2,522,250	\$17,147,250	\$0.0078
PADD V									
Case B1	0.145	\$2,325,000	\$55,000	\$4,200,000	\$355,000	\$240,000	\$1,248,440	\$8,423,440	\$0.0091
Case C	0.600	\$5,130,000	\$90,000	\$12,600,000	\$1,065,000	\$760,000	\$3,131,720	\$22,776,720	\$0.0059
V Total	0.745	\$7,455,000	\$145,000	\$16,800,000	\$1,420,000	\$1,000,000	\$4,380,160	\$31,200,160	\$0.0065
TOTAL B1	2.987	\$23,055,000	\$1,369,000	\$86,100,000	\$17,395,000	\$4,880,000	\$20,776,260	\$153,575,260	\$0.0080
TOTAL C	4.500	\$40,045,000	\$880,000	\$113,700,000	\$9,585,000	\$6,840,000	\$36,302,110	\$207,352,110	\$0.0072
TOTAL B1+C	7.487	\$63,100,000	\$2,249,000	\$199,800,000	\$26,980,000	\$11,720,000	\$57,078,370	\$360,927,370	\$0.0075



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Slide 13 Amortized Cost Per Gallon For Terminal & Retail Unit			
Expenses for R10/E5.7 By PADD			
<u>PADD</u>	<u>Case B1</u>	<u>Case C</u>	<u>Total</u>
I	\$0.0069	\$0.0072	\$0.0070
II	\$0.0078	\$0.0077	\$0.0077
III	\$0.0096	\$0.0075	\$0.0083
IV	\$0.0173	\$0.0065	\$0.0078
V	\$0.0091	\$0.0059	\$0.0065
Totals	\$0.0080	\$0.0072	\$0.0075



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Slide 14 Study Case B1 Average Freight Costs by PADD								
PADD	Ethanol shipped (bg)	Ethanol Imported From PADD II		Intra-PADD Ethanol Shipments			Total	Average freight per Gallon
		Ship/ barge	Rail	Truck	Rail	Barge		
I	1.3	\$57,400,000	\$70,000,000	\$13,125,000	-	\$4,000,000	\$144,525,000	\$0.1112
II	2.2	-	-	\$77,940,000	\$12,800,000	\$3,150,000	\$93,890,000	\$0.0427
III	0.7	\$2,555,000	\$35,275,000	\$8,025,000	-	\$300,000	\$46,155,000	\$0.0659
IV	0.1		\$4,500,000	\$200,000	-	-	\$4,700,000	\$0.0470
V	0.8	\$51,100,000	\$32,900,000	\$17,800,000	-	-	\$101,800,000	\$0.1273
TOTAL	5.1	\$111,055,000	\$142,675,000	\$117,090,000	\$12,800,000	\$7,450,000	\$391,070,000	\$0.0767



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Slide 15 Study Case C Average Freight Costs By PADD								
PADD	Ethanol shipped (bg)	Ethanol Imported From PADD II		Intra-PADD Ethanol Shipments			Total	Average freight per Gallon
		Ship/ barge	Rail	Truck	Rail	Barge		
I	2.7	\$80,040,000	\$61,875,000	\$49,562,500	--	\$4,000,000	\$195,477,500	\$0.0724
II	3.7	--	--	\$71,231,500	\$13,500,000	\$3,675,000	\$88,406,500	\$0.0239
III	1.8	\$4,650,000	\$46,325,000	\$40,830,000	\$6,650,000	\$6,300,000	\$104,755,000	\$0.0582
IV	0.4	--	--	\$21,043,750	\$8,500,000	--	\$29,543,750	\$0.0739
V	1.4	\$63,700,000	\$62,300,000	\$23,750,000	--	--	\$149,750,000	\$0.1070
TOTAL	10.0	\$148,390,000	\$170,500,000	\$206,417,750	\$28,650,000	\$13,975,000	\$567,932,750	\$0.0568



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Slide 16A Key Observations

- No major infrastructure barriers exist in Study Case B1. The volume of product moved by rail and river barge is a very small percentage of the products moved by those modes. The rail freight car building industry and the barge building industry have the capacity to build equipment at a faster pace than that of increasing ethanol shipments from new plants.
- The volume of ethanol shipped in Study Case B1 that would move in Jones Act/OPA90 compliant vessels is less than the volume of MTBE it would be replacing.
- No major infrastructure barriers exist for Study Case C, although more detailed study is needed to provide an accurate assessment of how many Jones Act/OPA90 compliant vessels will be available by the time frame when Case C production levels would be reached (i.e., probably 2015 or later).
- Terminal improvements represent significant capital investments for terminal operators although on an amortized basis, they equate to less than \$0.01 per gallon of new ethanol volume and, of course, a fraction of that on a blended gallon basis.



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Slide 16B Key Observations

- The costs of retail conversion for E-10/E-5.7 are modest on a per unit basis and present no major obstacle.
- E-85 retail station infrastructure costs are high, exceeding \$0.06 per gallon of new ethanol volume, for the combined Study Cases.
- Ethanol will not be routinely shipped by pipeline in either Study Case. Pipeline shipments of ethanol will be limited to niche situations, over short distances, in privately owned and operated systems.
- The most significant program costs will be for freight charges, which exceed \$391 million in Study Case B1, averaging \$0.0767 per gallon. In Study Case C, total freight charges exceed \$567 million and average \$0.0568 per gallon.



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Slide 17 Recommendations

- Various ways to reduce the costs of terminal blending systems should be explored.
- It is recommended that the impact of increased ethanol and ethanol coproduct shipments on the inland waterway system be studied more closely.
- It is recommended that a detailed assessment of Jones Act/OPA90 compliant vessels be undertaken. This should include OPA90 vessels in service and retiring, along with confirmed and projected ship orders. This, combined with projected “clean product” shipments, including ethanol, would yield a more accurate picture of the demand for these vessels. Simply put, the demand for OPA90 compliant Jones Act vessels, created by ethanol shipments between U.S. ports, cannot be assessed singularly. It must be assessed in the context of all vessels and all clean products shipments.



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Slide 18 DAI Phase II Report

**“Infrastructure Requirements for
an Expanded Ethanol Industry”**

www.afdc.doe.gov/pdfs/6235.pdf