U.S. Ethanol Industry
Production Capacity Outlook

Update of 2001 Survey Results
July 18, 2002

California Energy Commission staff conducted a survey of the U.S. ethanol industry between May and August 2001. This survey was designed to develop a complete and accurate inventory of the country's existing and planned ethanol production capacity during the period California is looking to increase its use of ethanol as a substitute for the gasoline additive MTBE. The results of this survey were published as an Energy Commission staff report, "U.S. Energy Industry Production Capacity Outlook" (August 2001), publication number P600-01-017, available on the Commission's website at: www.energy.state.ca.gov/reports/2001-08-29_600-01-017.PDF.

In order to gauge the extent of changes in the ethanol production capacity outlook since the original survey was completed, Energy Commission staff, during March -June 2002, performed an update of the survey results. Rather than undertake a complete re-survey of the industry with a detailed survey instrument as done in 2001, staff relied on a series of direct contacts with industry representatives, supplemented by other sources of published information, to develop the update. Figure 1 and Table 1 show the updated results for projected industry-wide ethanol production capacity at the end of years 2002 through 2005 in four categories: existing plants, existing plant expansions, new plants under construction, and new plants planned. Figure 2 is an update of scheduled month-to-month industry capacity growth for the same period.

Overall, the updated results reveal relatively minor changes to the industry-wide production capacity outlook reported in the original survey results. As concluded from the original survey, the U.S. ethanol industry still has plans to roughly double its production capacity over a four-year period, resulting in estimated industry-wide capacity of about 4.5 billion gallons per year by the end of 2005. By the end of 2002, total planned production capacity is estimated at 2.86 billion gallons per year. Some other observations from the updated survey results include:

- Six new ethanol plants, with a combined production capacity of 153 million gallons per year (MGY), have begun production since the 2001 survey was published.
- An additional 207 MGY of production capacity has been added via plant expansions completed since the original survey.
- Construction has begun on eight new plants, with a total production capacity of 217 MGY, since the original survey.
- Six additional ethanol plants, with a total production capacity of 225 MGY, were identified in the update. Four planned plants included in the 2001 survey results, with a total capacity of 30 MGY, are no longer included in the updated results.
- The update indicates some delays of scheduled plant start-up dates from the earlier years to the later years of the survey period.

Table 1. Summary Table of Update Changes (in Million Gallons/Year)					
Survey Differences		**2002**	**2003**	**2004**	**2005**
Existing Plants		375	375	375	375
Existing Plant Expansions		(196)	(213)	(203)	(203)
New Plants Under Construction		(87)	55	55	69
New Plants Planned		(217)	(51)	45	(107)
Net Differences (million gallons/year)		(125)	166	272	134
Net Differences (in per cent)		-4%	4%	7%	3%
2002 Update	**2001**	**2002**	**2003**	**2004**	**2005**
Existing Plants	2,219	2,594	2,594	2,594	2,594
Existing Plant Expansions		66	257	352	430
New Plants Planned		-	881	1,036	1,081
New Plants Under Construction		205	442	442	456
Total	**2,219**	**2,865**	**4,174**	**4,424**	**4,561**
2001 Survey	**2001**	**2002**	**2003**	**2004**	**2005**
Existing Plants	2,219	2,219	2,219	2,219	2,219
Existing Plant Expansions		262	470	555	633
New Plants Planned		217	932	991	1,188
New Plants Under Construction	82	292	387	387	387
Total	2,301	2,990	4,008	4,152	4,427
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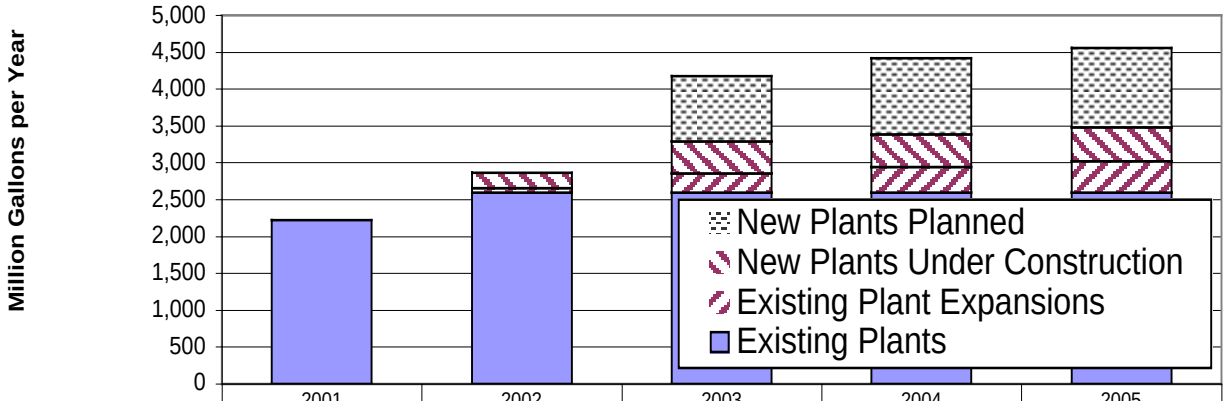
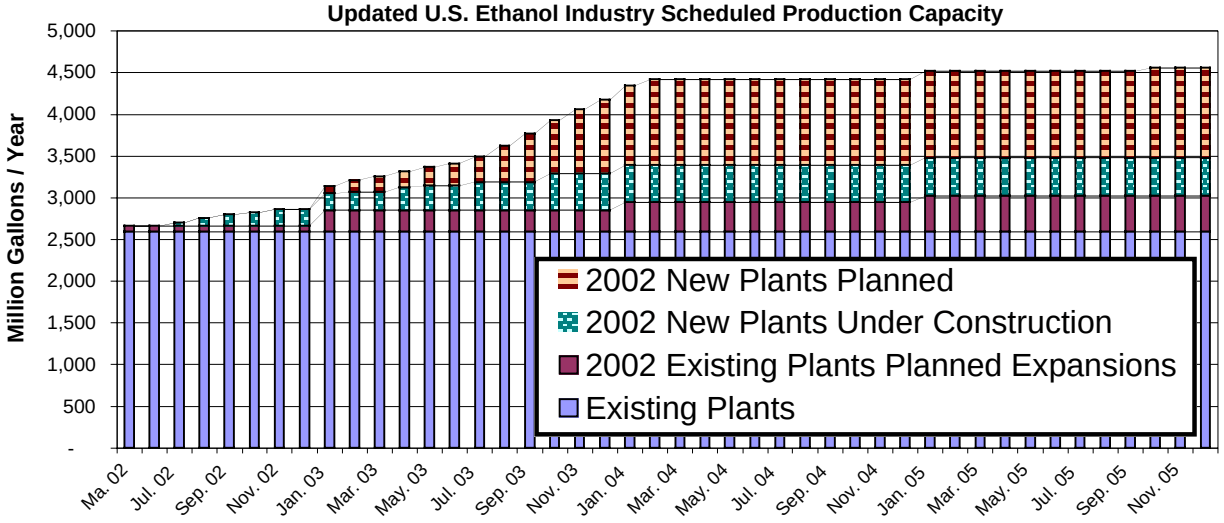
2002 Updated Figure 1.
USA Ethanol Production Capacity
@ End of Year



	2001	2002	2003	2004	2005
New Plants Planned		-	881	1,036	1,081
New Plants Under Construction		205	442	442	456
Existing Plant Expansions		66	257	352	430
Existing Plants	2,219	2,594	2,594	2,594	2,594

2002 Updated Figure 2.

Updated U.S. Ethanol Industry Scheduled Production Capacity



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CALIFORNIA
ENERGY
COMMISSION

U.S. ETHANOL INDUSTRY
PRODUCTION CAPACITY OUTLOOK

Results of a Survey Conducted by the
California Energy Commission

STAFF REPORT

AUGUST 2001
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Gray Davis, *Governor*

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Introduction

As a result of California s ongoing effort to phase out the use of the gasoline additive methyl tertiary butyl ether (MTBE), the ability to obtain adequate supplies of ethanol to replace MTBE in the state s gasoline supply has become of vital interest. Ethanol is the only other oxygenate component currently acceptable in California as an MTBE substitute.

Estimates of ethanol demand in California for MTBE replacement range from 660 to 950 million gallons per year (MGY) beginning in 2003, representing a four- to six-fold increase in the state s use of ethanol to date. The amounts of ethanol that will actually be required, and the rate of growth in state ethanol demand, depend on the following factors:

- The outcome of continuing state appeals for a waiver of federal oxygenated gasoline requirements.
- Progress toward air quality attainment in state air basins subject to this federal requirement.
- Decisions by the state regarding the MTBE phaseout schedule.
- Ethanol-gasoline blending economics.
- Gasoline formulation practices adopted by the state s gasoline refiners and marketers to comply with federal and state requirements for clean-burning gasoline.

As part of the state s investigation of the overall ethanol supply picture, the California Energy Commission has completed a survey of the U.S. ethanol industry. This survey is designed for the primary purpose of developing a complete and accurate inventory of the country s existing and planned ethanol production capacity during the next few years, as California moves to replace MTBE. Additional information pertinent to the U.S. ethanol industry s capability for supplying ethanol in adequate quantities, and of adequate quality, to meet California s needs was also elicited. The U.S. ethanol industry -- the individual companies along with the Renewable Fuels Association (RFA) and other associations representing the industry -- provided the Energy Commission with the needed cooperative assistance to complete this survey.

The results of the Energy Commission survey are presented in this report. The data compiled and presented here are based strictly on the survey results, as reported by the industry, with a minimum of interpretation or analysis. Ongoing analysis of the ethanol supply picture by Energy Commission staff will incorporate these survey results, together with other sources of information, to develop a more complete perspective on ethanol supply for California.

Survey Process

The Energy Commission staff developed a survey form that was distributed to the U.S. ethanol industry on May 18, 2001. The survey questionnaire was designed to obtain

information in three main categories:

- Existing ethanol production facilities
- Planned expansions of existing ethanol production facilities (through 2005)
- Planned new ethanol production facilities (through 2005)

Additional questions were asked regarding seasonal production variability, fuel marketing provisions, fuel quality and denaturant use, and shipping capabilities.

The original mailing list for the survey was compiled from a listing provided by the RFA, supplemented by additional contacts obtained from the U.S. Department of Energy, state agriculture and energy offices, ethanol plant constructors and other sources. Candidate respondents continued to be identified during the entire period in which survey responses were gathered, up to the date of this report. All of the existing and prospective ethanol producers comprising the original survey mailing list are accounted for in the survey results, along with a number of new prospective ethanol industry entrants identified during the course of the survey. Thus, the results presented here are considered to be the most complete inventory of current and likely near-term U.S. ethanol producers available at this time.

In addition to the planned new ethanol projects and existing plant expansions captured in the survey results, there are known to be many other potential new projects and some additional expansions in various stages of consideration. Existing plant expansions were included exactly as reported in the survey responses. The Energy Commission staff, in consultation with industry experts, exercised a degree of judgment in determining which planned new projects warranted inclusion in the survey results. Follow-up contacts were made in a number of cases to verify and clarify survey responses, confirm project timetables, etc.

In general, new projects included in the survey results exhibit all or most of the following characteristics:

- An operational proponent company
- A selected site
- An identified capacity and feedstock source
- A planned construction start date and operational date
- Engagement of the services of an engineering, procurement & construction firm (EPC), in most cases

Follow-on activities will continue to track progress of projects reported in the survey, as well as identify additional projects not captured in the results presented here. It is likely that additional viable projects will emerge within the period covered by the survey, and also possible that some of the projects included in the survey results may not proceed to completion.

As a condition of furnishing data for the survey, respondents were promised confidentiality with respect to the facility- and project-specific information supplied. Therefore, no company names, plant names, specific plant locations, or other project-specific or company-specific data are presented in this report. Instead, all information acquired in the survey has been aggregated for presentation in the various categories of data collected.

Summary of Survey Responses

The Energy Commission survey of the U.S. ethanol industry produced the following overall results:

- Number of companies responding 84
- Number of companies currently producing ethanol ..44
- Number of operating production plants 57
- Number of new companies with planned projects 40
- Number of new production plants under construction ..13
- Number of new production plants planned (not yet under const.) 34

Survey Results for Industry Expansion Plans

Figure 1 summarizes U.S. ethanol production capacity for the years 2001 through 2005, based on the survey results broken down by existing plant capacity, expansions of existing plant capacity, new plant capacity under construction, and capacity of new plants in planning stages. Table 1 provides an additional summary of planned industry-wide production capacity for the same five years, separately showing the contributions to capacity from existing producers plants and from new producers plants.

Figure 1.

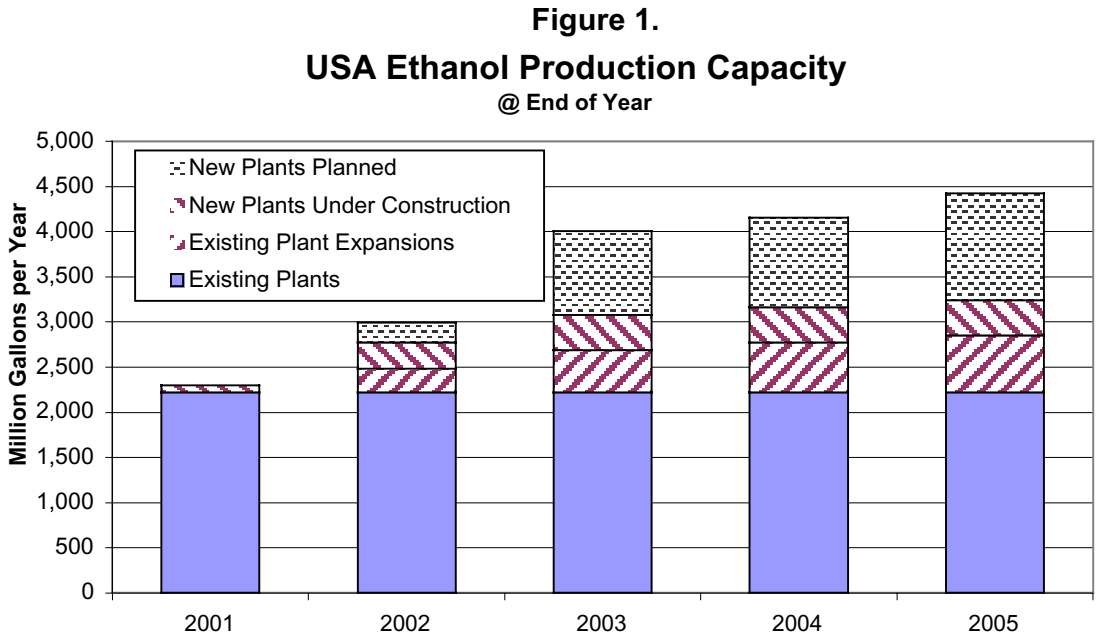


Table 1 Planned Growth of Industry Production Capacity
(Cumulative by End of Year)

		2001	2002	2003	2004	2005
Existing Industry	**Companies**	44	44	44	44	44
	Plants	57	58	58	58	58
	Capacity (MGY)	2219	2481	2689	2774	2852
New Entrants	**Companies**	4	21	40	40	40
	Plants	4	21	43	44	46
	Capacity (MGY)	82	518	1329	1387	1575
Existing & New Plants	**Companies**	48	65	84	84	84
	Plants	61	79	101	102	104
	Capacity (MGY)	2301	2999	4018	4161	4427

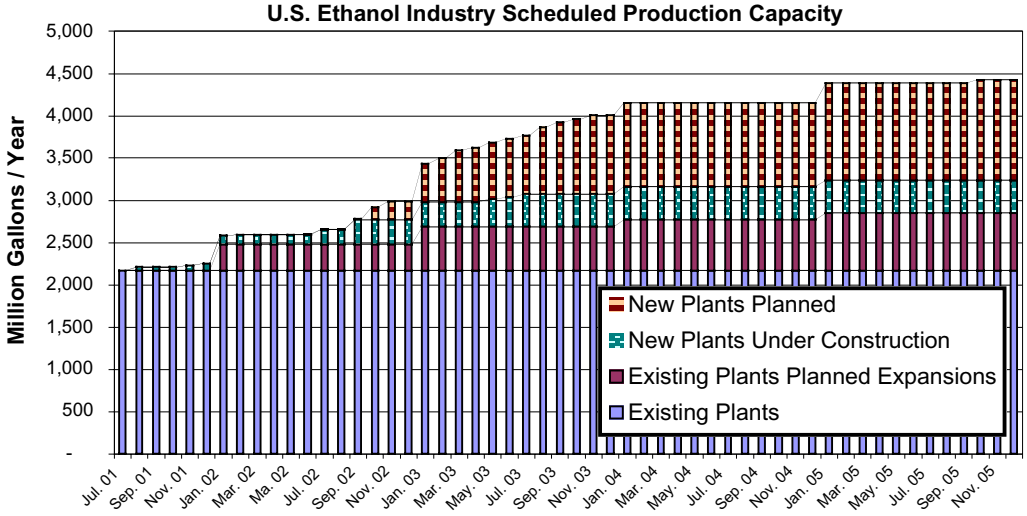
The survey results show that a major expansion of the U.S. ethanol industry is being undertaken. If all planned capacity additions and expansions included in the survey results are realized, the industry s production capacity will double by the end of 2005, from today s capacity of about 2200 MGY to about 4400 MGY. For the interim years, production capacity is planned to grow to about 3000 MGY by the end of 2002, 4000 MGY by the end of 2003 and 4200 MGY by the end of 2004. For historical perspective, the record for actual industry-wide ethanol production for a complete year was 1630 MGY in 2000 (as reported by RFA). For 2001, the industry is expected to establish a significantly higher production record, most likely exceeding 2000 MGY.

Several points regarding the different categories of industry expansion shown in Figure 1 and Table 1 are also noteworthy, including:

- Expansions of existing plant production capacities represent 262 MGY of additional capacity by the end of 2002, increasing to 633 MGY by the end of 2005.
- Plants under construction represent 292 MGY of new production capacity by the end of 2002, increasing to 387 MGY by the end of 2004.
- Additional plants in various stages of planning represent 942 MGY of new capacity by the end of 2003, increasing to 1198 MGY by the end of 2005.

Figure 2 provides a schedule of production capacity additions on a month-to-month basis for the period from July 2001 through December 2005. This figure shows when new increments of capacity are scheduled to come on line during this period.

Figure 2.



One question raised, but not completely resolved by the survey, involves the distinction between fuel-grade ethanol and ethanol supplied to the industrial-grade and beverage-grade ethanol markets. While survey respondents were asked to provide data on fuel-grade ethanol production capacity only, some amount (presumably not substantial) of ethanol production for the industrial or beverage markets may have been included in the tabulated survey results. In some cases, ethanol producers may have the flexibility to switch their ethanol production output among these various markets. Therefore, existing producers were asked in the survey if their plants could switch production from beverage-grade and/or industrial grade to fuel-grade ethanol. Of the survey respondents who replied to this question (about two-thirds of the existing producers), about 20 percent of the respondents indicated the capability to switch at least some beverage-grade or industrial-grade ethanol production to fuel-grade. The remainder of the existing producers responding to this question either answered no to this question or indicated that they produce fuel-grade ethanol only.

Production Capacity by Region and Company

Table 2 shows the regional distribution of U.S. ethanol production, for existing plants, for planned new plants, and for all plants combined. Plant capacity is shown by PADD (Petroleum Administration for Defense) Districts as a means of general regional distribution that does not reveal any specific plant locations. Illinois, Nebraska, Iowa and Minnesota are and will remain the top four ethanol-producing states, according to the survey results. South Dakota has the most planned ethanol projects (9), followed by Iowa (8), Nebraska (3), and Wisconsin (3). New plants are currently under construction in Iowa, South Dakota, Nebraska, Illinois, Wisconsin and Kansas. Several states are

scheduled to join the list of ethanol producers, including Montana, Washington, Oregon and New York.

Table 2 Existing and Planned U.S. Ethanol Production Capacity by PADD*

PADD District	Existing Plants		Planned Plants		All Plants (2005)	
	# of Plants	Cap (MGY)	# of Plants	Cap (MGY)	# of Plants	Cap (MGY)
District 1 (East Coast States)	0	0	2	26	2	26
District 2 (Midwest States)	48	2188	33	917	81	3707
District 3 (Gulf Coast States)	2	10	2	55	4	86
District 4 (Rocky Mountain States)	4	13	5	280	9	303
District 5 (West Coast States + AK & HI)	3	8	5	297	8	305
Totals	57	2219	47	1575	104	4427

PADD Districts are Petroleum Administration for Defense Districts, delineated by the federal government to facilitate allocation of petroleum fuels

California is currently home to two small ethanol producers. Two new projects planned in California are included in the survey results. The Energy Commission is aware of a number of other conceptual proposals for California ethanol projects, however, none of these is judged to have reached a firm enough stage of development to warrant inclusion in the survey results.

As noted earlier, the number of ethanol producers comprising the U.S. ethanol industry stands to nearly double based on the survey results, from the 44 existing producers to 84 producers by the end of 2005. The survey results also indicate that the industry s largest current ethanol producer will remain in this position, although its share of U.S. production capacity will decrease from about 45 percent to about 25 percent by the end of

2005. No other existing or prospective producer owns or will own more than about 5 percent of the nation s total ethanol production capacity.

No new ethanol plants equal in size to today s largest plants (200 MGY) are being planned. Several new plants in the 70 to 100 MGY range are planned, however, new plant sizes in the 20 to 40 MGY range appear most common. The average production capacity of new ethanol plants included in the survey results is 34 MGY.

Production Capacity by Feedstock

The survey results show that conventional production processes using corn as the feedstock will continue to predominate within the U.S. ethanol industry. Corn is listed as the feedstock for most existing plants, with two plants using milo and several plants using feedstocks such as cheese whey, beverage industry wastes, and potato waste. All expansions of existing plants, all plants under construction, and most new plants in planning will use corn as the feedstock. The few exceptions include two planned projects using barley and wheat, one using beverage industry wastes, one using sugar cane bagasse, two using forestry and wood wastes, one using rice straw and one using municipal wastes.

Shipping Capabilities

The survey asked respondents to indicate, on a plant-by-plant basis, for both existing and new plants, the capability to ship ethanol by rail, truck and barge. About 80 percent of the existing producers responded to this question. All of the existing producers responding indicated the capability to ship by truck, 77 percent indicated the capability to ship by rail, and 17 percent indicated the capability to ship by barge. Of the prospective new producers responding to this question (about 95 percent of responses), about 90 percent indicated the planned capability to ship by rail, 70 percent indicated the planned capability to ship by truck, and 30 percent indicated the planned capability to ship by barge.

Fuel Quality

Survey respondents with existing plants were asked to indicate if their ethanol production can comply with California Air Resources Board (CARB) specifications for denatured ethanol and the denaturants used. About 80 per cent of the existing producers responded to this question, with all respondents except one indicating current capability to produce ethanol fuel complying with CARB specifications. The remaining respondent indicated near-term plans to meet these specifications. Natural gasoline is the denaturant used by most producers, with a few respondents indicating they use unleaded gasoline or naptha.

Conclusions

The results of the Energy Commission s survey of the U.S. ethanol industry support the following major conclusions:

- 44 U.S. companies currently operate 57 ethanol production plants with a combined production capacity of about 2200 MGY.
- Planned expansions of existing U.S. ethanol facilities, if all completed as scheduled, will add 262 MGY of ethanol production capacity by the end of 2002, increasing to 633 MGY of additional capacity by 2005.
- 13 new U.S. ethanol plants with a combined production capacity of 387 MGY are currently under construction.
- Besides the plants under construction, additional new U.S. ethanol production plants included in the survey results, if all completed as scheduled, will add 226 MGY of new production capacity by the end of 2002, increasing to 1198 MGY of new capacity by the end of 2005.
- The combination of existing plants, with expansions, and new planned facilities, if all completed as scheduled, will double the U.S. ethanol industry s production capacity, from today s 2200 MGY to 4400 MGY by the end of 2005.
- The U.S. ethanol industry will remain centered in the Midwestern corn-growing states through 2005, with Illinois, Nebraska, Iowa and Minnesota the top ethanol-producing states.