

Gasohol Production using Biomass Ethanol from Sugarcane in Vietnam

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Japan Energy Research Center Co. Ltd.

Vietnam

Land area : 330,000 km²

Population : 76,000,000

Industry : Agriculture

Proceeding "Sugar program"

Production of Major Crops

1,000 ton

	1980	1990	1993	1995	1996	1997	1998
Paddy	11,647	19,225	22,837	24,964	26,397	27,524	29,142
Spring rice	3,874	7,846	9,032	10,737	12,210	13,310	13,560
Summer rice	1,594	4,110	5,144	6,501	6,879	6,638	7,523
Winter rice	6,180	7,269	7,724	7,726	7,309	7,576	8,060
Other cereals							
Maize	429	671	832	1,177	1,537	1,651	1,612
Sweet potatoes	2,418	1,929	2,480	1,685	1,697	1,691	1,517
Cassava	3,323	2,276	2,548	2,190	2,067	2,403	1,783
Potatoes	872	365	259				
Annual industrial crops							
Sugar cane	4,359	5,398	6,083	10,701	11,430	11,921	13,844

Sources: "Statistical data of Agriculture , 1 9 9 9" (from 1990 to 1998)
 Forestry and Fishery: Dept. of Agriculture , Forestry and Fishery
 "Vietnam's Agriculture" Tran Thi Que, Institute of Asian Studies
 (year 1980 and Potatoes)

Sown area and Production of Sugarcane by Provinces

	Sown area				Production
	1,000 ha				1,000 ton/y
	1995	1996	1997	1998	1998
Red river delta	3.4	3.6	3.1	3.0	123
North east	9.3	11.1	13.2	14.5	514
North west	6.2	7.5	9.8	10.2	395
North central coast	10.6	15.5	21.7	32.5	1,530
South central coast	42.0	47.4	48.5	55.3	2,451
Central highland	11.3	16.0	17.9	16.4	621
North east south	44.0	43.9	54.0	58.2	2,672
Mechong river delta	98.0	92.0	88.8	92.9	5,539
Total	224.8	237.0	257.0	283.0	13,845

Sugarcane Factories by Regions (Vietnam)

Region	Factory	Total capacity (ton/day)	Ratio (%)	Average capacity (ton/day)
North	15	30,700	39.3	2,050
Central	15	19,350	24.7	1,290
South	14	28,150	36.0	2,010
Total	44	78,200	100.0	1,780

Source : Personal contact

Brazil's Ethanol Fuel History

1931 Mandate alcohol added to gasoline up to 5%

1941 Ethanol production reached to 650 M kl/y

1975 "Proalcool" program started.

Gasoline A/B : regular/premium leaded

C : 22 vol. % ethanol

1979 Neat ethanol in addition to Gasoline C

1989 600 distilleries capable of ethanol 16 MM kl/y

1996 352 units producing sugar and alcohol :

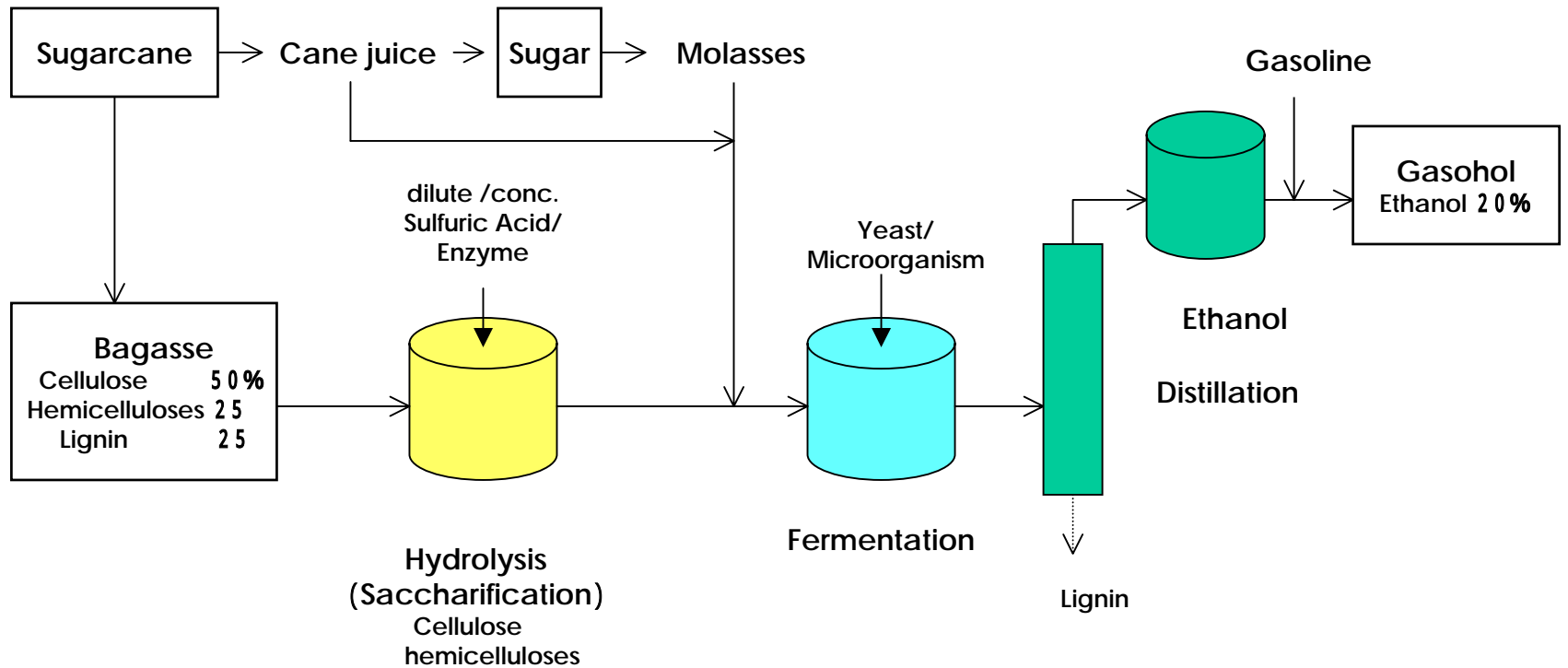
196 sugar/ alcohol, 135 sole alcohol and 21 sole sugar

Sugarcane 286 MM tons : 13.6 MM tons of sugar/ 14.4 MM kl of ethanol

Ethanol from sole ethanol units occupied up to 65%.

Sugarcane plantation area is 4.2 MM ha.

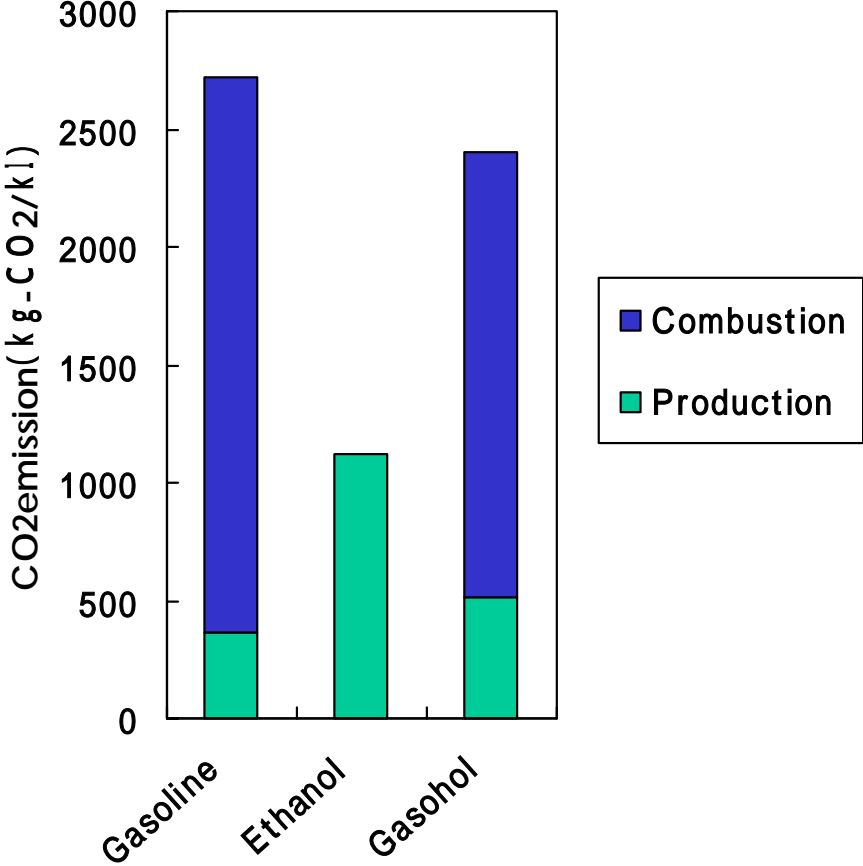
Sugarcane to Gasohol



Biomass to Ethanol projects in the U.S.A

Company, Location	Start-up	Technology	Feedstock	Ethanol Production
BCI Jennings, LA	2002	Two-stage dilute acid	Bagasse	76,000 kl/y
Masada Middletown, NY	2002	Concentrated acid	MSW	38,000
Arkenol Sacramento, CA	2002	Concentrated acid	Rice straw	46,000
BCI/Gridery LLC Gridrey, CA	2003	Enzymatic	Agricultural wastes and Wood wastes	76,000
Sealaska Southeast Alaska	2004	To be determined	Softwood wastes	23,000 ~ 30,000
BCI/Collines Plne Chester, CA	2004	Enzymatic	Softwood wastes	76,000

CO₂ Emission Reduction Effect of Gasohol

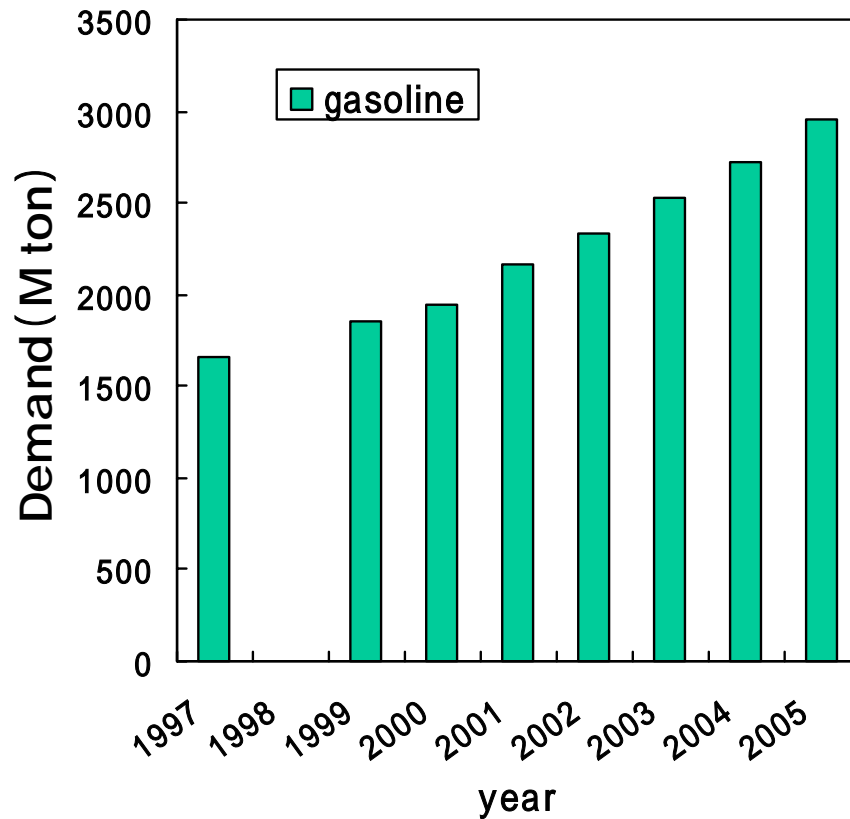


Life-cycle Analysis

Gasohol blended with 20 wt% ethanol

CO₂ emission of gasohol is reduced around 6%

Forecast of Gasoline Demand



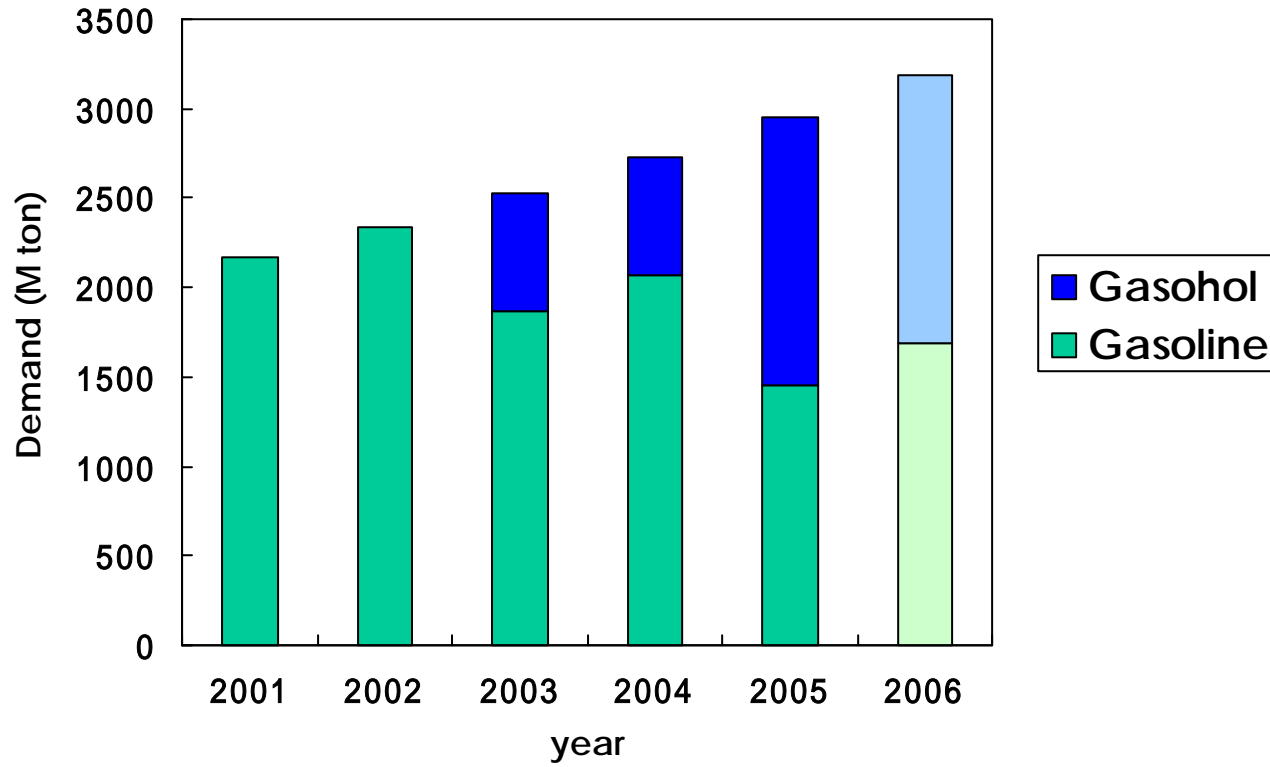
Year	M ton
1999	1,900
2005	2,950

(4,000 M kl)

Increasing rate 8%/y

Leaded-gasoline has
been supplied.

Gasohol Introduction Project



Required Ethanol Production

- Gasohol is supplied up to 50% of gasoline demand in 2005.
Gasohol : gasoline blended with 20 wt % of ethanol
- Ethanol production is required 380 M kl/y in 2005.

Case 1 : Sugar and ethanol production

Sugarcane production 10.8 MM ton (Sown area 180 M ha)
Sugar production 1,300 M ton

Case 2 : Sole ethanol production

Sugarcane production 4.8 MM ton (Sown area 80 M ha)

C O 2 Emission Reduction Effect

One Ethanol Factory capacity

	Case 1	Case 2
Sugarcane treatment	6,700 T/D	6,700 T/D
Ethanol production	42,000 kl/y	96,000 kl/y
Sugar production	144,000 T/y	

C O 2 emission reduction (unit: M C O 2-ton/y)

	2001	→	2003	→	2005	→
Baseline	8,070		9,412		1,0992	
Reduction Case 1	-		306		690	
Case 2	-		350		700	

Cost performance of CO₂ reduction (considering sugar and ethanol credits)

Case 1 1,200 yen/CO₂-ton (10 \$/CO₂-ton)

Case 2 9,500 yen/CO₂-ton (79 \$/CO₂-ton)

Additional effects

- Lead reduction by gasohol introduction
310 t/y in 2005

- New employment in 2005

	Case 1	Case 2
Farmers	17,000	7,600
Employee	6,300	2,600