

Thailand Ethanol Situation: Overview & Update (Part II)

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Beginning of 2007

➤ Demand (Consumption)

- 400,000 - 500,000 Litres/day
- Target 800,000 Litres/day

➤ Supply (Capacity)

- 855,000 Litres/day
(from molasses 725,000 Litres,
from cassava 130,000 Litres)

➤ Government Policy

- Mandate gasohol 95, 91

➤ Feedstock Prices

- Molasses at 2,300 Baht/Ton
- Cassava at 1,640 Baht/Ton

Now

➤ Demand (Consumption)

- 1,200,000 Litres/day

➤ Supply (Capacity)

- 2,575,000 Litres/day and expanding
(from molasses 1,645,000 Litres, from
cassava 630,000 Litres, from dual
300,000 Litres)

➤ Government Policy

- Price Gap
- Increasing no. of gasohol gas stations
- Introduce E20, E85

➤ Feedstock Prices

- Molasses at 5,400 Baht/Ton
- Cassava at 2,000 Baht/Ton

Demand (Consumption)

Sales of petroleum products

Unit: Million Litres

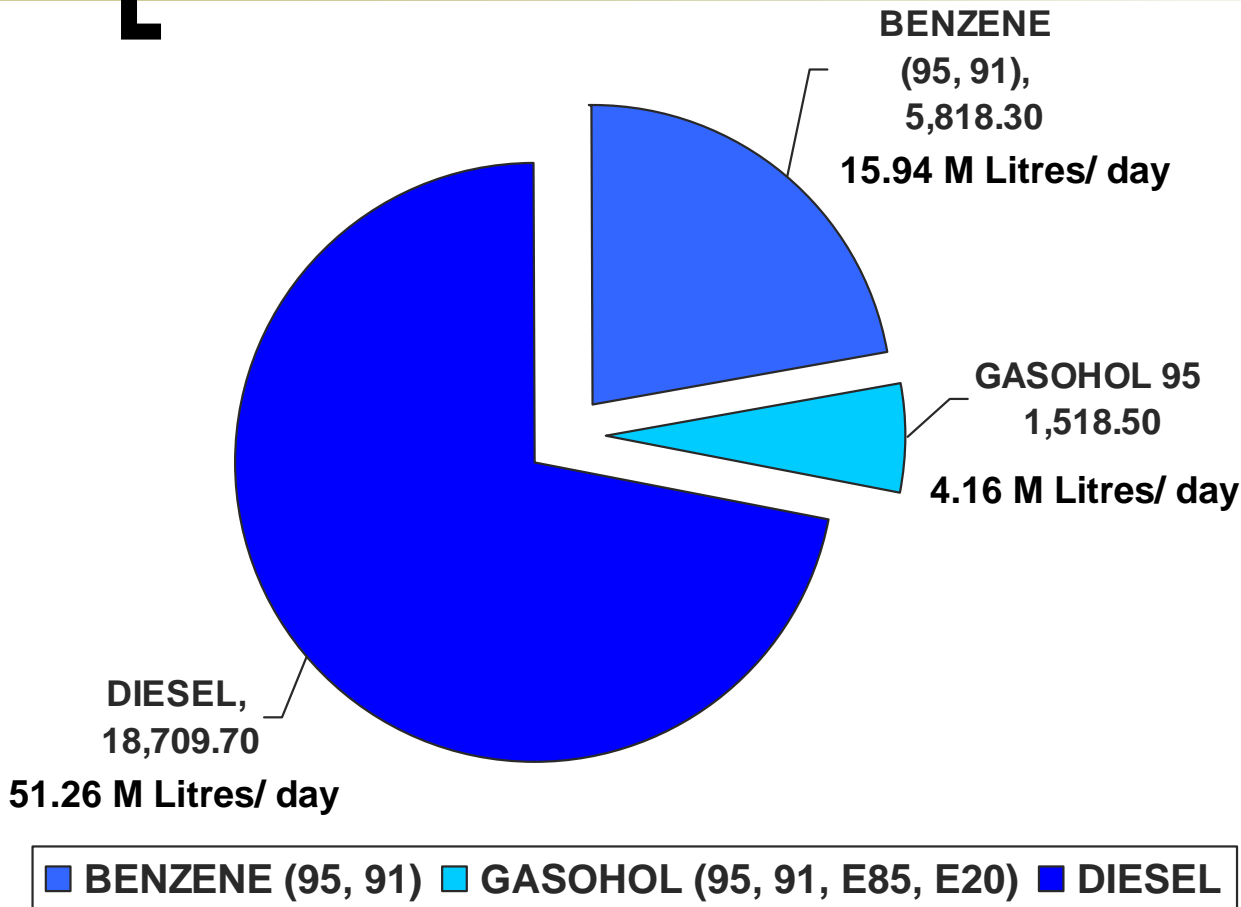
TYPE	2005	2006	2007	2008	2009
BENZENE (95, 91)	6,573	5,936	5,818	4,625	4,468
GASOHOL (95, 91, E85, E20)	675	1,279	1,518	2,468	3,056
DIESEL	19,594	18,371	18,710	17,643	18,465
LPG (MKG)*	2,923	3,212	5,812	6,828	6,894
NGV (MMCF)*	2,351	3,946	8,587	28,286	52,087

* MKG : Million Kilograms , MMCF : Million Cubic Feet

Source: Energy Policy and Planning Office (EPPO)

Sales of petroleum products in 2007

Unit: Million litres



Ethanol (approx. 10% mix)

= 151.85 M Litres

Benzene (approx. 90% mix)

= 1,366.65 M Litres

Or 0.42 M Litres of ethanol / day

Ethanol = 2.07 %

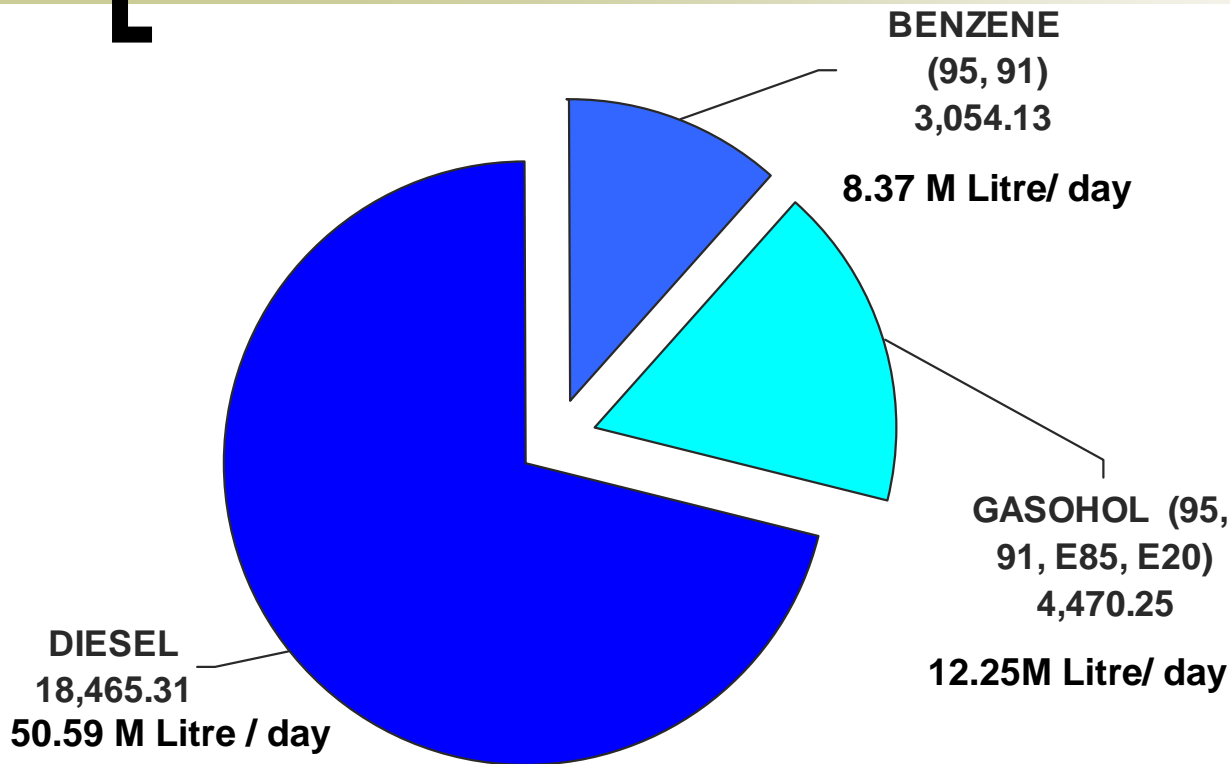
Benzene = 97.93 %

* Exclude LPG and NGV

Source: Energy Policy and Planning Office (EPPO)

Sales of petroleum products 2009

Unit: Million litre



Ethanol (approx. 10% mix)
= 447.02 M Litre

Benzene (approx. 90% mix)
= 4,023.22 M Litre

Or 1.22 M Litre of ethanol / day

Ethanol = 5.90 %

Benzene = 94.1 %

■ BENZENE (95, 91) ■ GASOHOL (95, 91, E85, E20) ■ DIESEL

* Exclude LPG and NGV

Source: Department of Energy Business, Energy Policy and Planning Office

Supply (Capacity)



Production Capacity break down by feedstock

Source: Ministry of Energy (January 2010)

Company	Schedule Completed	Capacity Register			
		Molasses & Cane	Molasses & Cassava	Cassava	Total
1. Pornvilai	Completed 2006	25,000			25,000
2. Thai Alcohol		200,000			200,000
3. Thai Agro Energy		150,000			150,000
4. Thai Ngyuan Ethanol				130,000	130,000
5. Khon Kaen Alcohol		150,000			150,000
6. Petro Green (Phukiew)		200,000			200,000
7. Thai Sugar Ethanol	Completed 2007	100,000			100,000
8. KI Ethanol		100,000			100,000
9. Petro Green (Kalasin)	Completed 2008	200,000			200,000
10. Aekarat Pattana		200,000			200,000
11. Thai Roong Ruang Energy		120,000			120,000
12. Ratchaburi Ethanol	Completed 2009		150,000		150,000
13. ES Power			150,000		150,000
14. Mae Sod Clean Energy		200,000			200,000
15. Sub Thip				200,000	200,000
16. P.S.C. Starch Products				150,000	150,000
17. Tai Phing			150,000	150,000	
Total		1,645,000	300,000	630,000	2,575,000

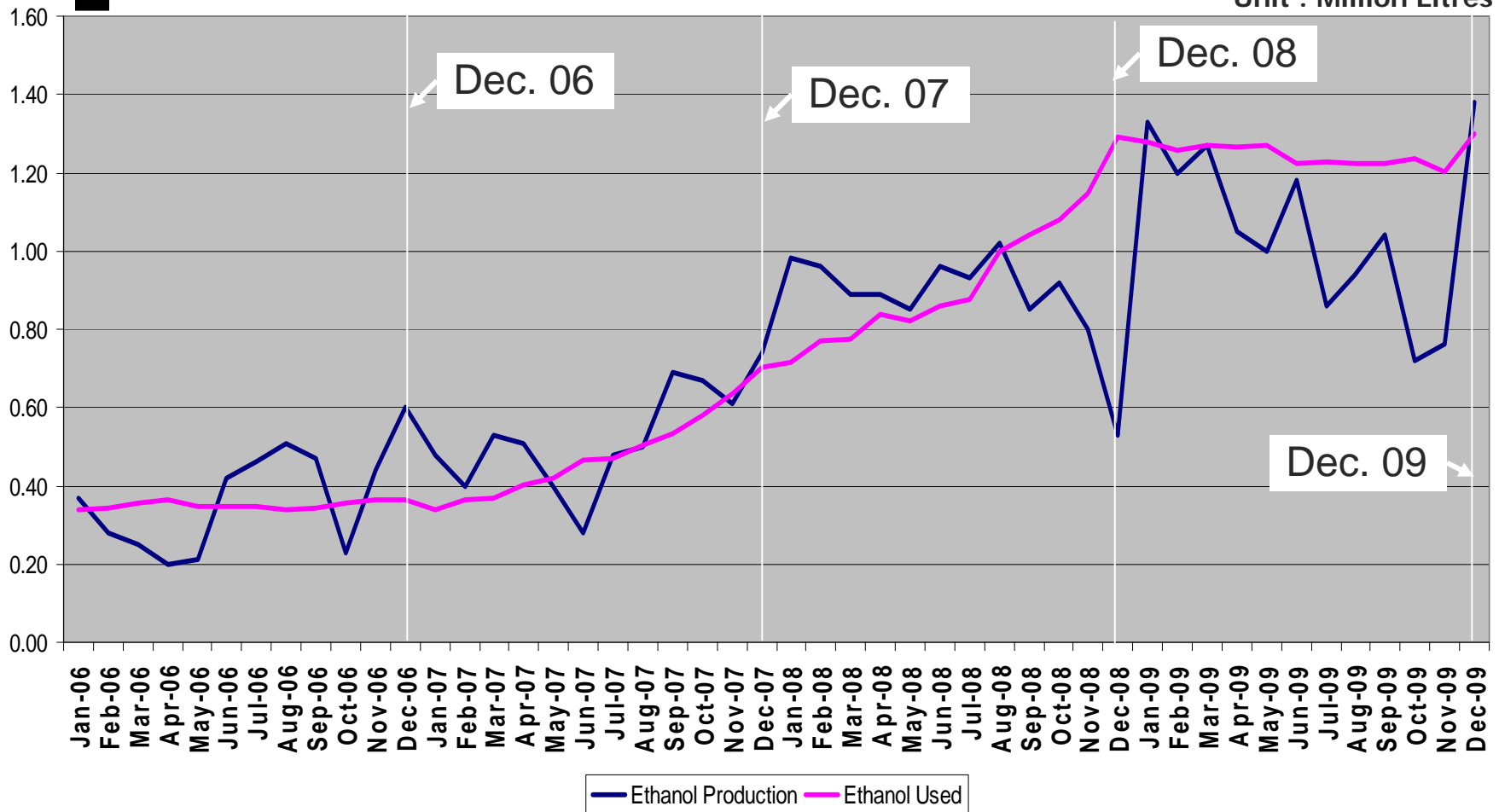
Production Capacity break down by feedstock (cont.)

Source: Ministry of Energy (January 2010)

		Capacity Register			
Company	Schedule Completed	Molasses & Cane	Molasses & Cassava	Cassava	Total
18. Fah Kwan Thip	 2010 	200,000		60,000	60,000
19. Petro Green (Suphanburi)				200,000	200,000
20. Double A Ethanol				500,000	500,000
21. Sima Inter Product				150,000	150,000
22. P.T.K. Ethanol				1,020,000	1,020,000
Total		200,000	0	1,730,000	1,930,000
Grand Total		1,845,000	300,000	2,360,000	4,505,000
22 Projects		1,350,000		6,835,000	8,185,000
Grand Total		3,195,000	300,000	9,195,000	12,690,000

Ethanol Demand and Supply

Unit : Million Litres

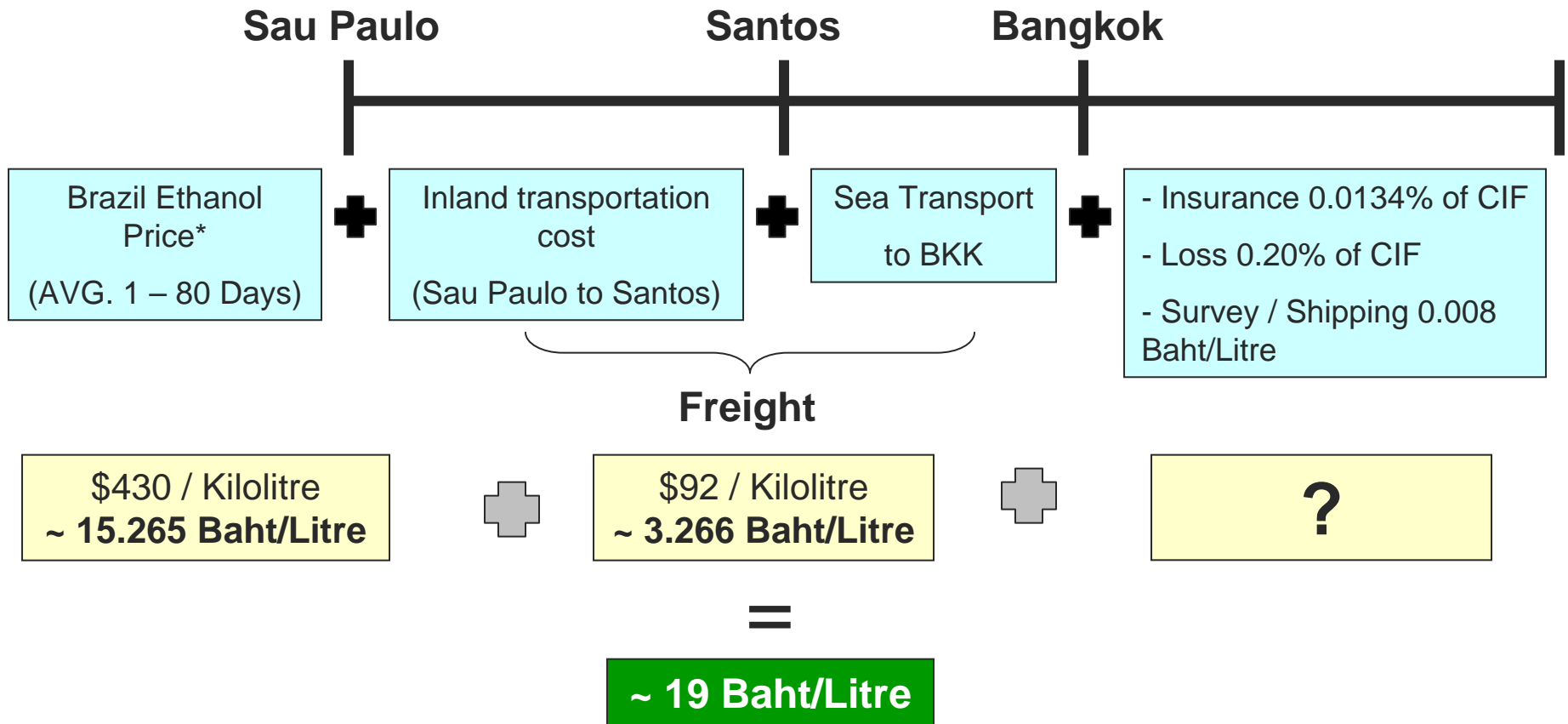


Source: 1. Supply - Office of Alternative Energy Development and Efficiency (DEDE)
 2. Demand - Energy Policy and Planning Office (EPPO)

Government Policy

The Import parity price

As of Jan. 2007



*Brazilian Commodity Exchange Sao Paulo, from Reuters, Alcohol Fuel-Front Month Continuation trading in the range of day 1-80 in the previous quarter (average)

[Cost plus]

As of Mar. 2010

$$\begin{aligned} \text{Cost of Ethanol price} &= \frac{(P_{\text{Mol}} \times Q_{\text{Mol}}) + (P_{\text{Cas}} \times Q_{\text{Cas}})}{Q_{\text{Total}}} \\ &= 20.16 \text{ Baht/Litre} \end{aligned}$$

$$\begin{aligned} \text{Cost of Ethanol price from Molasses } (P_{\text{Mol}}) &= R_{\text{Mol}} + C_{\text{Mol}} \\ 20.1779 &= 14.0529 + 6.125 \text{ Baht/Litre} \end{aligned}$$

$$\begin{aligned} \text{Cost of Ethanol price from Cassava } (P_{\text{Cas}}) &= R_{\text{Cas}} + C_{\text{Cas}} \\ 20.1018 &= 12.9948 + 7.107 \text{ Baht/Litre} \end{aligned}$$

Quantity of ethanol production from molasses	= 968,424	litre/day
Quantity of ethanol production from cassava	= 31,892	litre/day
Total quantity of Ethanol production	= 1,000,316	litre/day
Cost of molasses	= 3.53	baht/kg.
Cost of ethanol production from molasses	= 6.125	baht/litre
Cost of cassava root	= 1.34	baht/kg.
Cost of cassava chip	= 3.49	baht/kg.
Cost of ethanol production from cassava	= 7.107	baht/litre

Price Structure for Ethanol in Thailand (2007)

Unit: Baht/Litre

	EX-REFIN. (AVG)	TAX B./LITRE	M. TAX B./LITRE	OIL FUND (1)	CONSV. FUND	WHOLE SALE PRICE (WS)	VAT	WS&VAT	MARKET ING MARGIN	VAT	RETAIL PRICE
ULG 95R	15.7957	3.6850	0.3685	3.4600	0.0400	23.3492	1.6344	24.9836	1.4078	0.0985	26.49
ULG 91R	15.3549	3.6850	0.3685	3.2600	0.0400	22.7084	1.5896	24.2980	1.3009	0.0911	25.69
GASOHOL	16.9512	3.3165	0.3317	1.5000	0.0360	22.1354	1.5495	23.6849	1.2198	0.0854	24.99

As of Jan 3, 2007

Source: Energy Policy and Planning Office (EPPO)

Price Structure for Ethanol in Thailand (2007)

Unit: Baht/Litre

- ULG 95R = 26.49
 - GASOHOL = 24.99
 - ULG 91R = 25.69
- $>$ = 1.50

As of Jan 3, 2007

Source: Energy Policy and Planning Office (EPPO)

Price Structure for Ethanol in Thailand (Now)

Unit: Baht/Litre

	EX-REFIN. (AVG)	TAX B./LITRE	M. TAX B./LITRE	OIL FUND (1)	CONSV. FUND	WHOLESALE PRICE(WS)	VAT	WS&VAT	MARKETING MARGIN	VAT	RETAIL PRICE
ULG 95R	19.3600	7.0000	0.7000	7.5000	0.2500	34.8100	2.4367	37.2467	4.8536	0.3397	42.44
ULG 91R	18.9086	7.0000	0.7000	6.7000	0.2500	33.5586	2.3491	35.9077	1.4321	0.1002	37.44
GASOHOL95 E10	19.6258	6.3000	0.6300	2.8000	0.2500	29.6058	2.0724	31.6782	2.0204	0.1414	33.84
GASOHOL91	19.4052	6.3000	0.6300	1.4000	0.2500	27.9852	1.9590	29.9442	2.2391	0.1567	32.34
GASOHOL95 E20	19.8007	5.6000	0.5600	-0.4000	0.2500	25.8107	1.8067	27.6174	3.6659	0.2566	31.54
GASOHOL95 E85	20.0400	1.0500	0.1050	-11.0000	0.2500	10.4450	0.7312	11.1762	7.5176	0.5262	19.22

As of Mar 16, 2010

Source: Energy Policy and Planning Office (EPPO)

Price Structure for Ethanol in Thailand (Now)

Unit: Baht/Litre

•ULG 95R	= 42.44	>	= 8.6
•GASOHOL 95	= 33.84		
•ULG 91R	= 37.44	>	= 5.1
•GASOHOL 91	= 32.34		
•GASOHOL E20	= 31.54		
•GASOHOL E85	= 19.22		

As of Mar 16, 2010

Source: Energy Policy and Planning Office (EPPO)

Number of gas stations that have gasohol pumps

Type	May 2008	2008	2009
GASOHOL E85	-	4	5
GASOHOL E20	93	194	271
GASOHOL 91 E10 (to replace ~ 12 Million Litre ULG 91)	1,650	2,662	2,741
GASOHOL 95 E10 (to replace ~ 8 Million Litre ULG 95)	3,975	4,023	4,111

Source: Office of Alternative Energy Development and Efficiency (DEDE)

Gas stations in Thailand categorized by region

Region	2006		2007		2008		2009	
	Gasohol	All	Gasohol	All	Gasohol	All	Gasohol	All
Bangkok	-	868	701	903	703	892	694	881
Perimeter	-	545	351	593	361	623	364	632
Central	-	1,160	244	1,169	257	1,173	262	1186
Northern	-	4,274	649	4,317	702	4,376	732	4,409
Northeastern	-	5,941	676	6,184	808	6,394	864	6,355
Eastern	-	1,442	413	1,470	452	1,541	465	1,551
Western	-	1,790	396	1,793	419	1,772	432	1,778
Southern	-	1,973	392	2,105	464	2,128	474	2,143
Total	3,466	17,993	3,822	18,534	4,166	18,902	4,287	18,935
	19%	100%	21%	100%	22%	100%	23%	100%

Source: Office of Alternative Energy Development and Efficiency (DEDE)

Feedstock Prices

Molasses, cane and cassava as the feedstock

Source: Office of Cane and Sugar Board and Office of Agricultural Economics

Unit : Million Tons

Year	Molasses			Cane			Cassava		
	Production	Domestic	Export	Production	Domestic	Export	Production	Domestic	Export
2004	2.94	1.48	1.46	64.48	17.43	47.05	21.44	5.23	16.21
2005	2.26	1.17	1.09	47.82	18.53	29.29	16.94	3.70	13.24
2006	2.16	1.59	0.57	46.68	19.45	27.23	22.58	4.20	18.38
2007	3.04	2.49	0.55	63.80	19.91	43.89	26.92	6.50	20.42
2008	3.20	2.50	0.70	73.31	19.95	53.36	25.16	9.65	15.51
2009	3.01	2.51	0.50	66.46	19.40	47.06	30.09	11.43	18.66
Avg.	2.77	1.96	0.81	60.43	19.11	41.43	23.86	6.79	16.40

$$(0.50 \times 238)=119$$

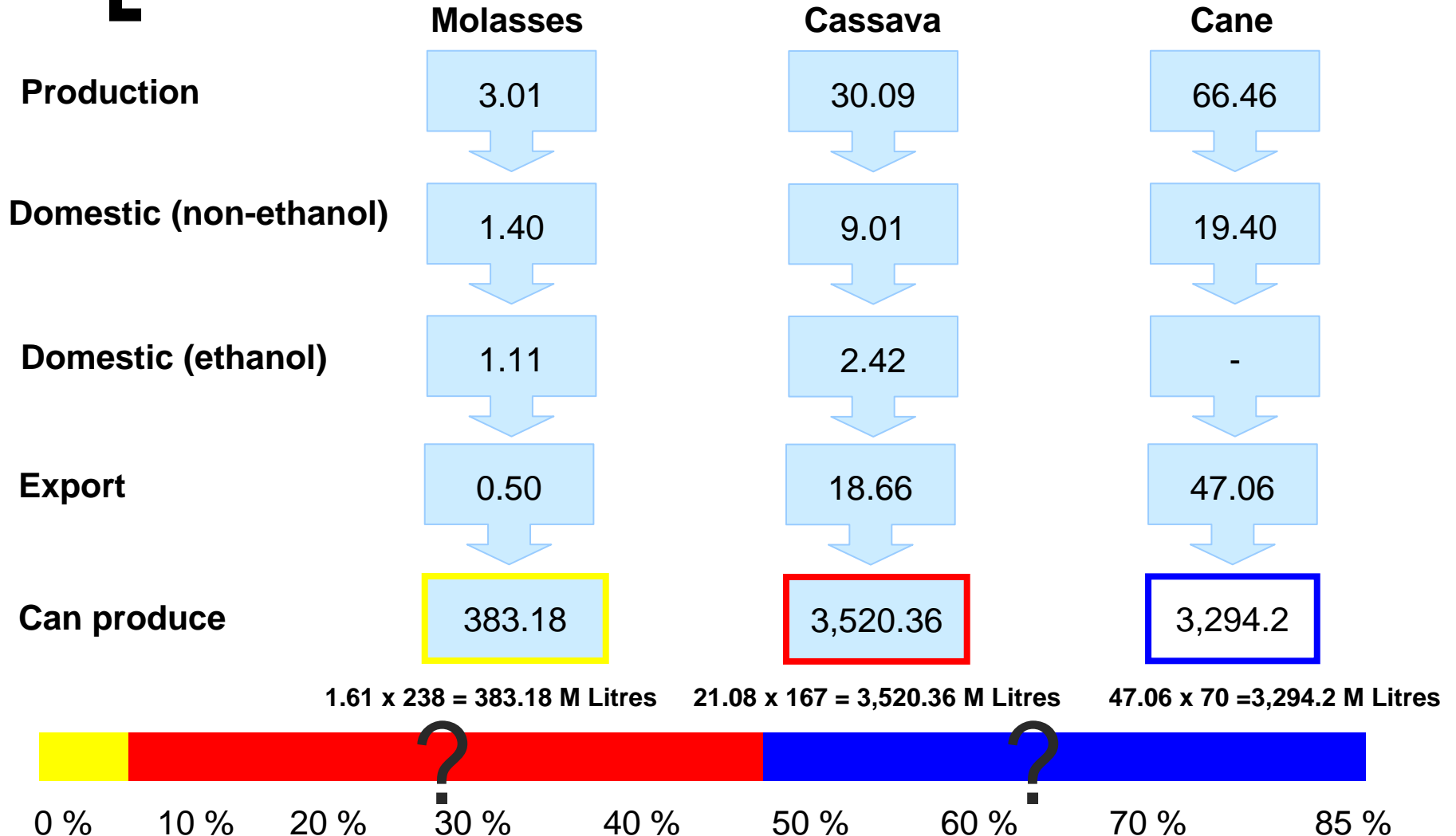
$$(47.06 \times 70)= 3,294$$

$$(18.66 \times 167)= 3,116$$

**Additional ethanol that can produce from feedstock export = 6,529 Million Litres
or approximately 87 % of the current use of benzene in Thailand**

Feedstock balance 2009

Unit : Million MT



Average prices of the feedstock

Year	Molasses (Baht/Ton)	Cane* (Baht/Ton)	Cassava (Baht/Ton)
2004	1,109	568	800
2005	2,172	745	1,330
2006	3,100	929	1,290
2007	2,300	783	1,640
2008	2,100	926	1,950
2009	3,300	1,043	1,868
First 3 years avg.	2,127	747	1,140
Last 3 years avg.	2,567	921	1,819

Note : * At average C.C.S.

Source: Office of Cane and Sugar Board and Office of Agricultural Economics

Ethanol costs from each feedstock

Year	Molasses (Baht/Ton)	Cane (Baht/Ton)	Cassava (Baht/Kg.)
2004	4.66	8.11	4.79
2005	9.13	10.64	7.96
2006	13.02	13.27	7.72
2007	9.66	11.18	9.82
2008	8.82	13.23	11.68
2009	13.86	14.90	11.18
First 3 years avg.	8.94	10.67	6.82
Last 3 years avg.	10.78	13.10	10.89

Source: Office of Cane and Sugar Board and Office of Agricultural Economics

Estimated prices and Ethanol cost of the feedstock in 2010

	Molasses (Baht/Ton)	Cane (Baht/Ton)	Cassava (Baht/Ton)
Estimated prices	5,400	1,200	2,000
Estimated cost	22.69	17.14	11.98

[The future]

➤ Short-term

- Flat demand
- Rising feedstock prices
- Increasing competition

➤ Long-term

- Focus at government policy
- World trend
 - Environment
 - Higher energy cost
 - Energy independent

[Conclusion]

- Real demand ← government policy
- Real supply ← feedstock prices
- Ping-Pong situation between molasses and cassava prices