

# FUEL'S QUALITY & FURURE SUGGESTED STAGES FOR FUEL'S QUALITY IN VIETNAM

Hà Nội, tháng 1 năm 2009



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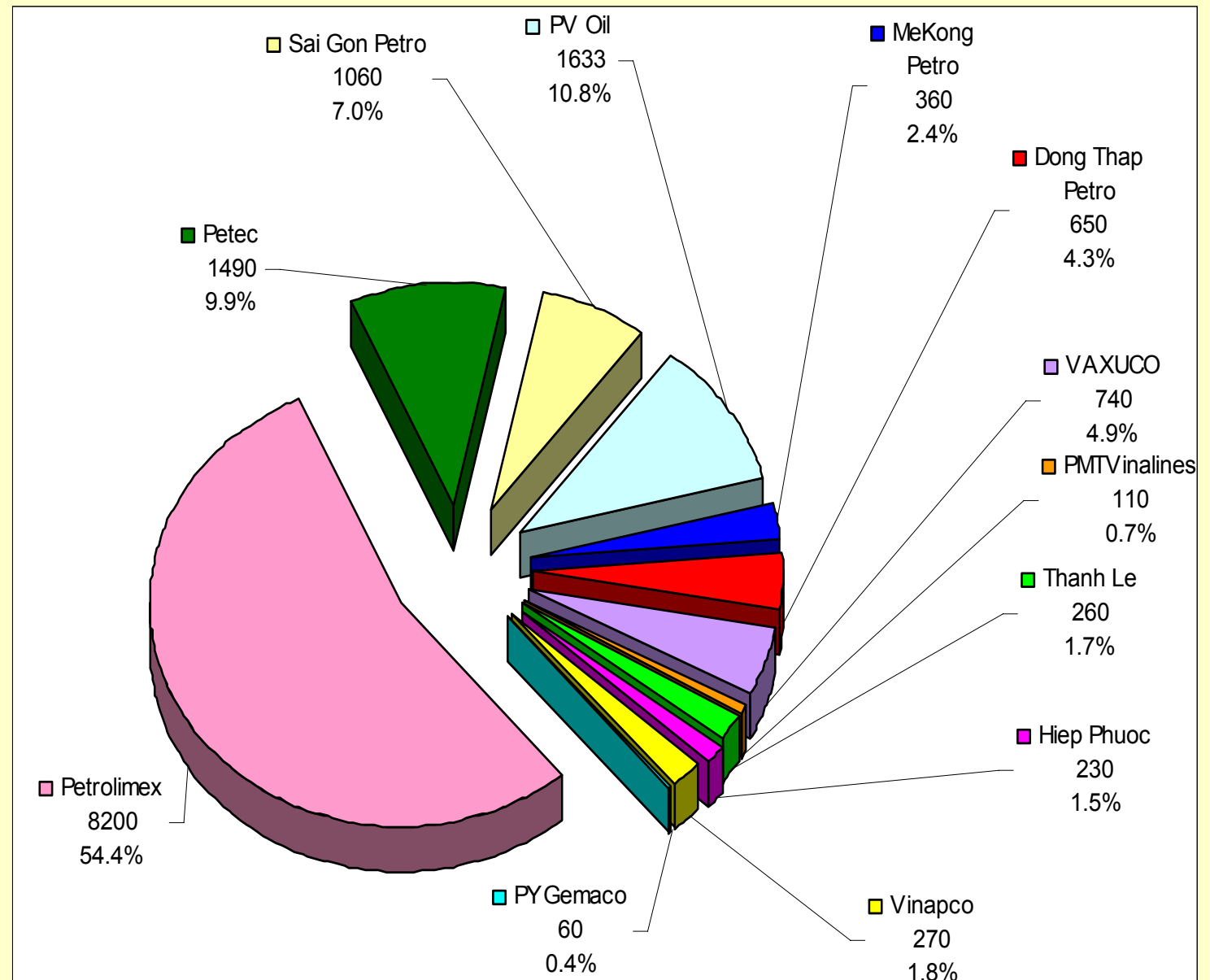
- 1. Petroleum fuel consumption in Vietnam in 2008.**
- 2. Survey of fuel quality in Vietnam.**
- 3. The parameters determining octane number**
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## THE IMPORTED QUOTA IN 2008 FOR ALL PETROLEUM FUELS

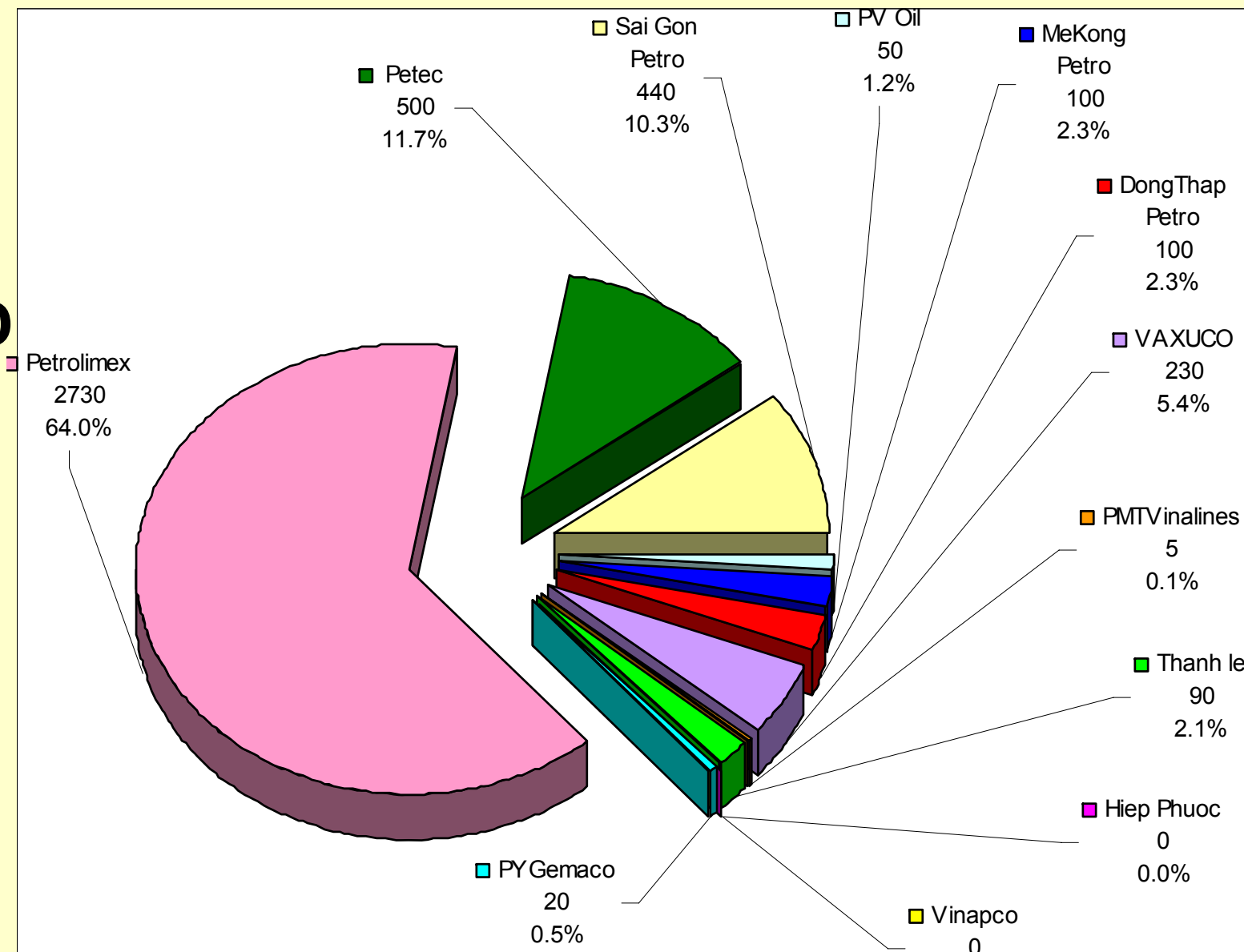
1000m<sup>3</sup>/ Ton

No	Name of Company	Total	Gasoline	DO	FO	KO	Zet A1
	<b>Total</b>	<b>15,063</b>	<b>4,265</b>	<b>6,825</b>	<b>2,080</b>	<b>258</b>	<b>270</b>
1	Petrolimex Corporation	8200	2730	3860	1480	130	
2	Petec	1490	500	770	190	30	
3	Sai Gon Petro	1060	440	560	20	40	
4	PV Oil	1633	50	170	40	7.5	
5	Me Kong Petroleum JV	360	100	230	20	10	
6	Dong Thap Petro Trading	650	100	500	30	20	
7	VAXUCO	740	230	480	20	10	
8	PMTVinalines	110	5	55	50		
9	Thanh Le	260	90	160		10	
10	Hiep Phuoc	230	0	0	230		
11	Vinapco	270	0	0			270
12	PYGEMACO	60	20	40			

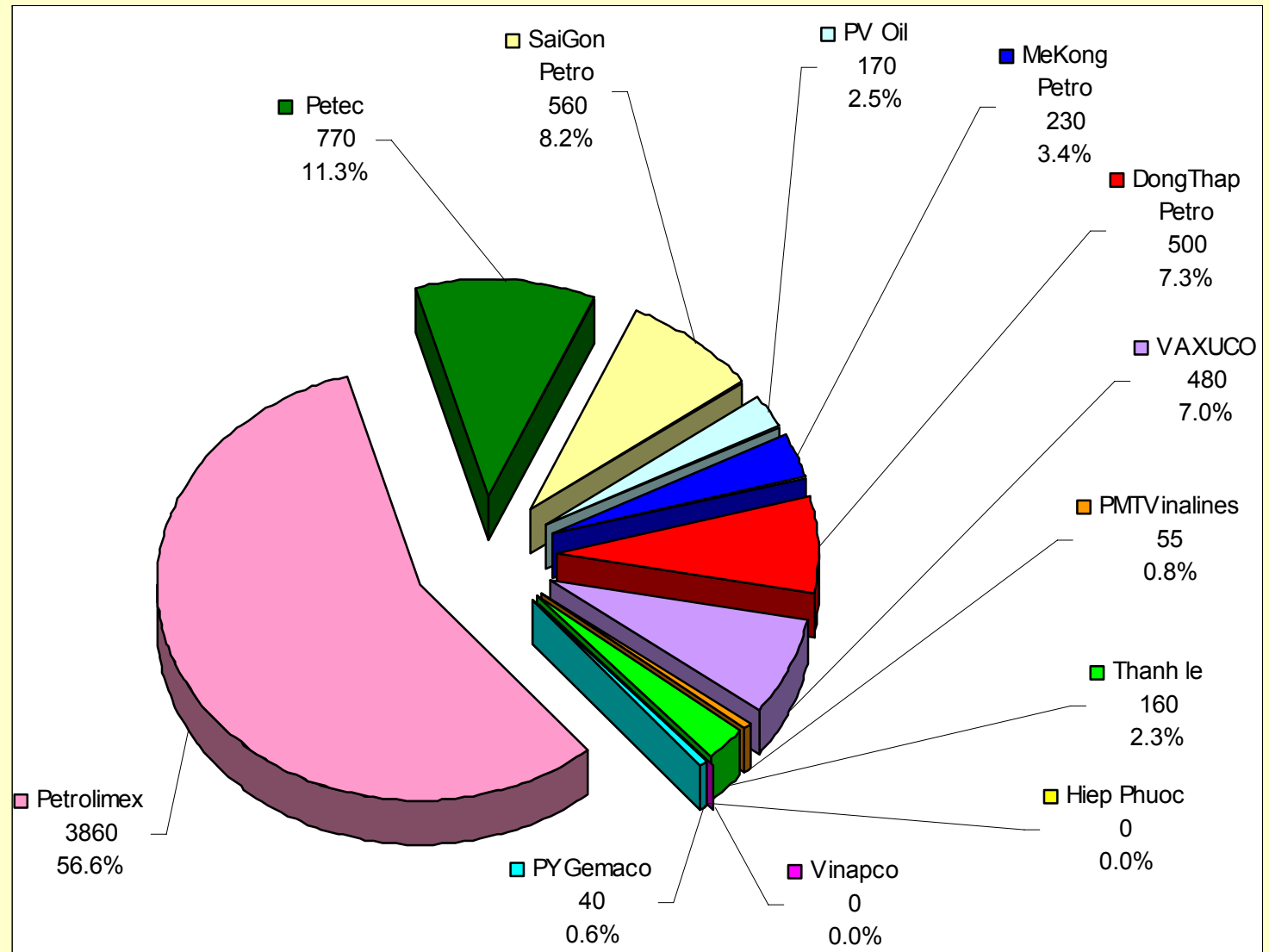
## THE IMPORTED QUOTA IN 2008 FOR ALL PETROLEUM FUELS



## THE IMPORTED QUOTA IN 2008 FOR GASOLINE



## THE IMPORTED QUOTA IN 2008 FOR DIESEL

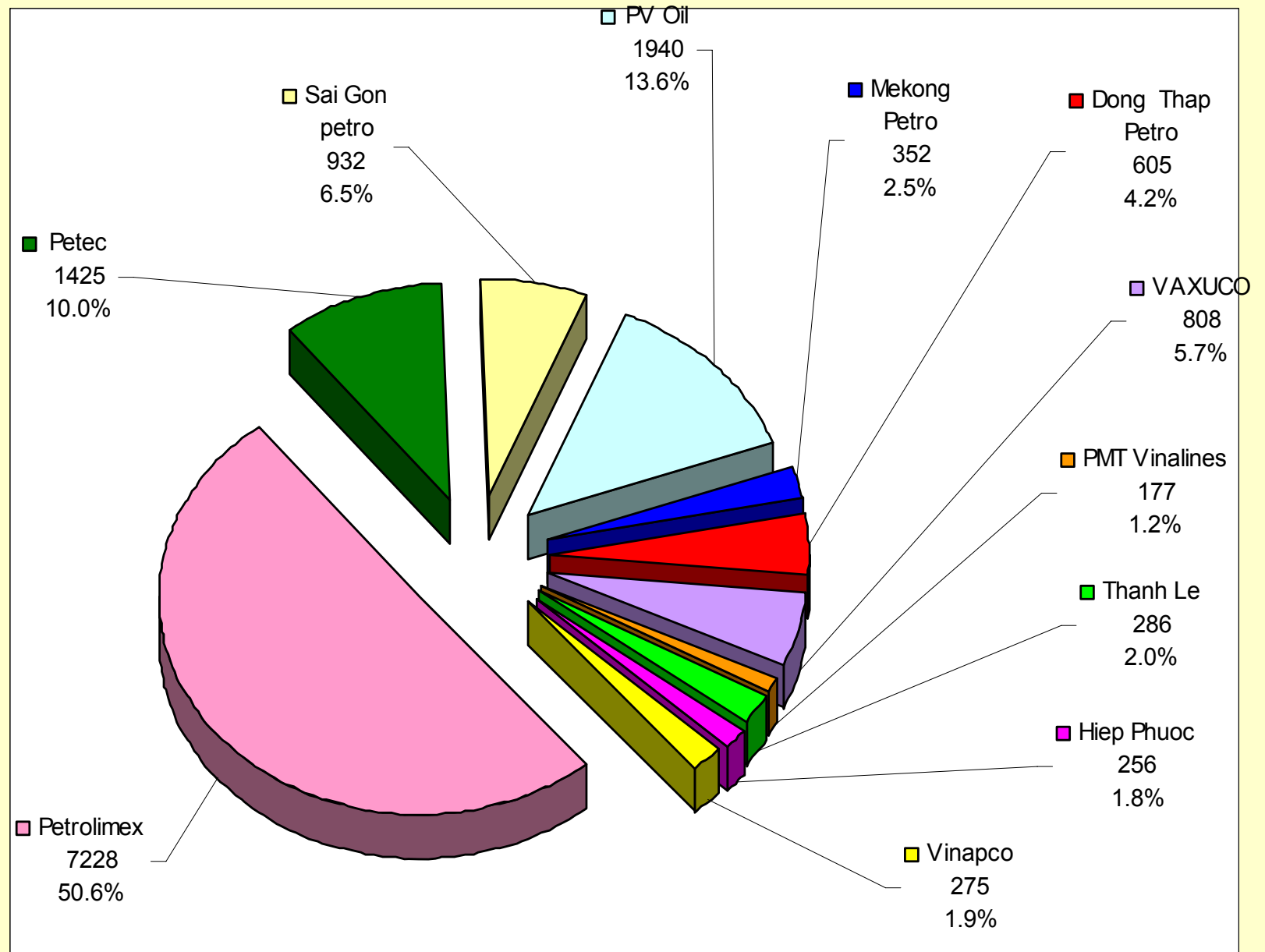


## THE IMPORTED FUELS IN 2008

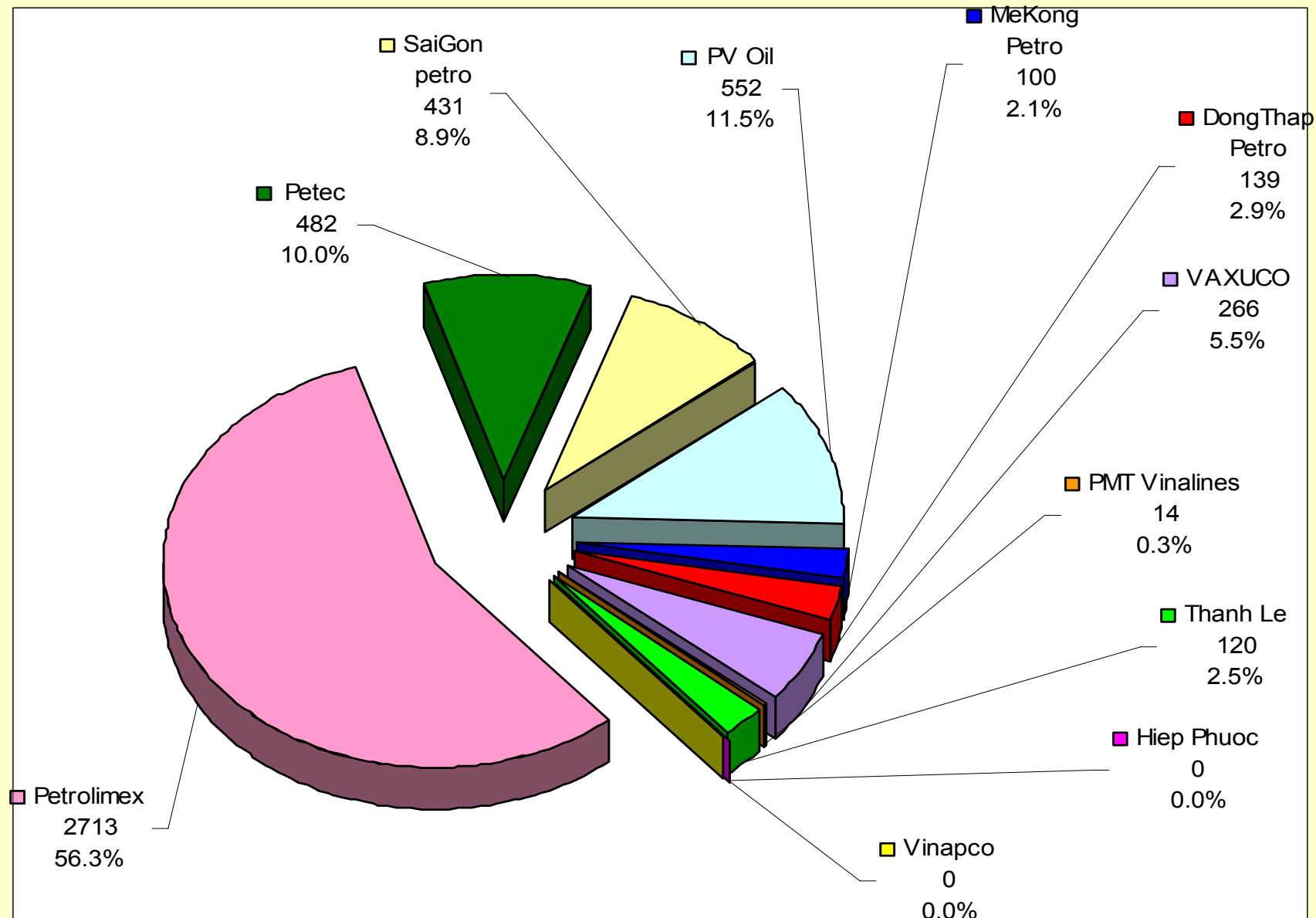
Unit: 1000 ton for FO;  
1000m<sup>3</sup> for others

No	Name of Company	Total	Gasoline	DO	FO	KO	Zet A1
	<b>Total</b>	<b>14,284</b>	<b>4,817</b>	<b>7,302</b>	<b>1,743</b>	<b>145</b>	<b>275</b>
1	Petrolimex	7228	2713	3440	1003	71	
2	Petec	1425	482	708	211	24	
3	Sai Gon Petro	932	431	466	12	23	
4	PV Oil	1940	552	1283	91	14	
5	Me Kong Petroleum JV	352	100	240	8	4	
6	Dong Thap Petro Trading	605	139	446	10	9	
7	VAXUCO	808	266	490	52		
8	PMT Vinalines	177	14	63	100		
9	Thanh Le	286	120	166			
10	Hiep Phuoc	256			256		
11	Vinapco	275					275

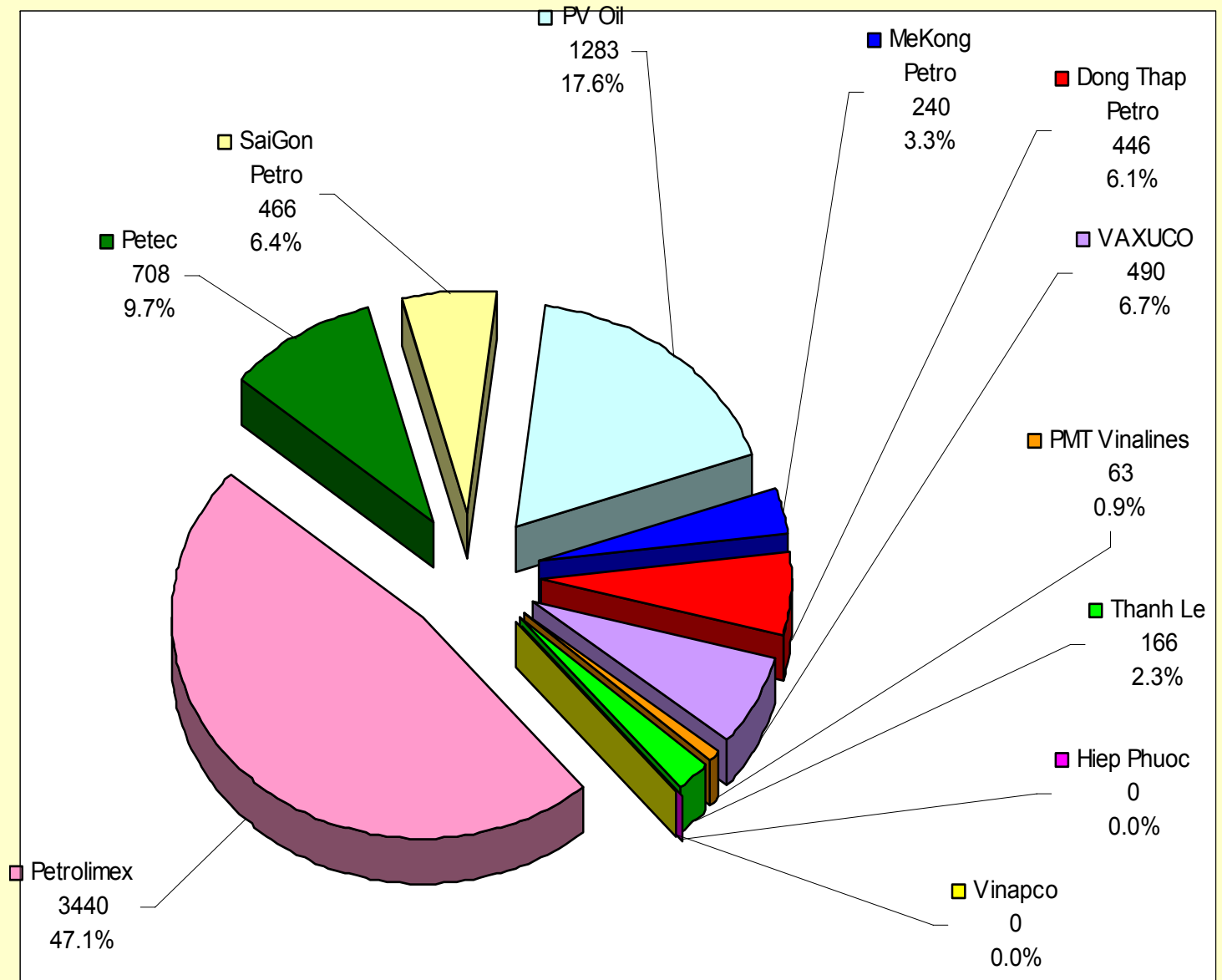
## THE IMPORTED FUELS IN 2008



## THE IMPORTED GASOLINE IN 2008



## THE IMPORTED DIESEL IN 2008



## Gasoline specifications TCVN 6776: 2005

	Property	Unleaded Gasoline			Test Method
		90	92	95	
1	Octane number, min				
	- RON (*)	90	92	95	ASTM 2699
	- MON (**)	79	81	84	ASTM 2700
2	Lead content, g/l, max	0.013			ASTM D3237
3	Distillation				
	- IBP, oC	Report			
	-10% vol, oC, max	70			
	- 50% vol, oC, max	120			ASTM D86
	- 90% vol, oC, max	190			
	- FBP, oC, max	215			
	- residual, %vol, max	2			
4	Copper corrosion @50oC/3hrs, max	1			ASTM D130
5	Existent gum, mg/100ml, max	5			ASTM D381
6	Induction period, minutes, min	480			ASTM D525

## Gasoline specifications TCVN 6776: 2005 ( continued)

7	<b>Sulfur content, mg/kg, max</b>	<b>500</b>	ASTM D 5453
			ASTM D2622
8	<b>RVP @37.8oC, KPA</b>	<b>43-75</b>	ASTM D5191
			ASTM D4953
9	<b>Benzene, %vol, max</b>	<b>2.5</b>	ASTM D4420
			ASTM D3606
10	<b>Aromatics, % vol, max</b>	<b>40</b>	ASTM D1319
11	<b>Olefin, % vol, max</b>	<b>38</b>	ASTM D1319
12	<b>Oxygen content, % wt, max</b>	<b>2.7</b>	ASTM D4815
13	<b>Density@15oC, kg/m3</b>	<b>Report</b>	ASTM D4052
			ASTM D1298
14	<b>Metal content (Fe, Mn), mg/l, max</b>	<b>5</b>	ASTM D3831
15	<b>Appearance</b>	<b>Clear, no impurities</b>	ASTM D4176
16	<b>Acetone</b>	<b>No addition</b>	ASTM D4815

## DIESEL SPECIFICATIONS TCVN 5689:2005

No	Property	500	2500	Test Methods
1	Sulphur Content, mg/kg, max	500	2500	ASTM D2622 ASTM D 5453
2	Cetane Index, min	46		ASTM D4737
3	Distillation, oC -90% Vol, Max	360		ASTM D86
4	Flash Point, DEC C, min	55		ASTM D3828 ASTM D93
5	Viscosity at 40 DEG C, cSt	2-4.5		ASTM D445
6	CCR on 10% distillation Residue , Wt PCT, max	0.15		ASTM D189 ASTM D4530
8	Ash, Wt PCT, max	0.01		ASTM D482

## DIESEL SPECIFICATIONS TCVN 5689:2005 ( continued)

9	Water, mg/kg, max	<b>200</b>	ASTM E 203
10	Particulate Contaminant, mg/l, max	<b>10</b>	ASTM D 2276
11	Copper Strip Corrosion at 50 DEG C, 3hrs, max	<b>1</b>	ASTM D 130
12	Density at 15 DEG C, kg/m <sup>3</sup>	820-860	ASTM D 4052
			ASTM D1298
13	Lubricity, μm, max	<b>460</b>	ASTM D 6079
14	Appreance	<b>Clean, clear</b>	ASTM D 4176
	More Imported specs for Petrolimex		
15	Colour ASTM,Max	<b>2</b>	ASTM.D1500
16	Strong Acid Number Mg KOH/G	<b>Nil</b>	ASTM.D974
17	Total Acid Number % Mass	<b>0.25</b>	ASTM.D974
18	Sediment by Extraction	<b>0.05</b>	ASTM.D473

- **1. Compression ratio**
- **2. Air- fuel ratio**
- **3. Ignition timing**
- **4. Effect of temperature & load**
- **5. Engine speed**
- **6. Engine deposit, air temperature, altitude, humidity**
- **7. Engine management systems**

## 1. EFFECT OF COMPRESSION RATIO

For a typical carburetted engine without engine management.

<b>Compression Ratio</b>	<b>Octane Number Requirement</b>	<b>Brake Thermal Efficiency ( Full Throttle )</b>
5:1	72	-
6:1	81	25 %
7:1	87	28 %
8:1	92	30 %
9:1	96	32 %
10:1	100	33 %
11:1	104	34 %
12:1	108	35 %

## 2.EFFECT OF CHANGING AIR- FUEL RATIO

- Traditionally, the greatest tendency to knock was near 13.5:1 air-fuel ratio for engine specific.
- Modern engines, with engine management systems, now have their maximum octane requirement near to 14.5:1
- maximum power occurs around air-fuel 12-13:1 (Rich), maximum thermal efficiency occurs around air-fuel 16-18:1 (Lean)

## 3. EFFECT OF CHANGING THE IGNITION TIMING

- The tendency to knock increases as spark advance is increased.
- For an engine with recommended 6 degrees BTDC ( Before Top Dead Centre ) timing and 93 octane fuel, retarding the spark 4 degrees lowers the octane requirement to 91, whereas advancing it 8 degrees requires 96 octane fuel

### - Basic Ignition Timing

• Vehicle	Retarded 5 degrees	Standard	Advanced 5 degrees
• A	88	91	93
• B	86	90.5	94.5
• C	85.5	88	90
• D	84	87.5	91
• E	82.5	87	90

## 4. EFFECT OF TEMPERATURE & LOAD

- **Increasing the engine temperature, particularly the air-fuel charge temperature, increases the tendency to knock.**
- **Knock increases as load increases**

## 5. EFFECT OF ENGINE SPEED

**Faster engine speed reduces the tendency to knock**

## 6. EFFECT OF ENGINE DEPOSITS, AIR TEMPERATURE, ALTITUDE, HUMIDITY.

- A new engine may only require a fuel of 6-9 octane numbers lower than the same engine after 25,000 km. The deposits produce the ORI by several mechanisms:
  - They reduce the combustion chamber volume, effectively increasing the compression ratio.
  - They also reduce thermal conductivity, thus increasing the combustion chamber temperatures.
  - They catalyse undesirable pre-flame reactions that produce end gases with low autoignition temperatures.
- An increase in ambient air temperature of 5.6C increases the octane requirement of an engine by 0.44 - 0.54 MON
- Octane number requirement decreased by 1.0 - 1.9 RON/300m.
- An increase of absolute humidity of 1.0 g water/kg of dry air lowers the octane requirement of an engine by 0.25 - 0.32 MON.

## 7. EFFECT OF ENGINE MANAGEMENT SYSTEMS

- Engine management systems are now an important part of the strategy to reduce automotive pollution.
- A modern engine management system can compensate for altitude, ambient air temperature, and fuel octane. The management system will also control cold start settings, and other operational parameters.
- a new requirement that the engine management system also contain an on-board diagnostic function that warns of malfunctions such as engine misfire, exhaust catalyst failure, and evaporative emissions failure.
- The use of fuel of too low octane can actually result in both a loss of fuel economy and power, as the management system may have to move the engine settings to a less efficient part of the performance map. The system retards the ignition timing until only trace knock is detected.

## QUANTITY OF REGISTRATED MOTOBIKES IN RECENT YEARS

1	YEAR	2005	2006	2007
2	QUANTITY	2.1 mil	2.55mil	3.26mil

NOTE: THE NUMBER REGISTRATED MOTOBIKES INCREASE RAPIDLY

## QUANTITY OF REGISTRATED VEHICLES

1	YEAR	2008	2015
2	QUANTITY		
	TOTAL	24 mil	
	MOTOBIKE	23mil	35 mil
	AUTOMOBILE	1mil	



# THE OCTANE NUMBER REQUIREMENT OF VEHICLES IN VIETNAM

Manufacturer	Name	Compression ratio	ON
<b>Honda</b>	Air blade	11:1	≥ 95
	Click	11:1	
	Spacy 125cc	9,5:0	
	Future neo	9,3:1	≥ 92
	Future neo F1		
	Future II		
	Super dream	9:1	
	Wave RS		
	Wave RSX		
	Wave S		
	Wave alfa		
	Wave ZX		
	Wave 1		
	Wave RSV		
	Future		
Super dream Deluxe			



# THE OCTANE NUMBER REQUIREMENT OF VEHICLES IN VIETNAM

Manufacturer	Name	compression ratio	ON
<b>Yamaha</b>	Sirius	9,3:1	≥ 92
	Sirius R		
	Sirius R limited		
	Jupiter MX		
	Jupiter gravita		
	Jupiter gravita RC		
	Jupiter gravita limited	11:1	≥ 95
	Exciter RC		
	Exciter GP		
	Nouvo 110 limited	8,8:1	≥ 92
	Nouvo 110 RC		
	Mio Classico		
	Mio Maximo		
	Mio Ultimo		



# THE OCTANE NUMBER REQUIREMENT OF VEHICLES IN VIETNAM

Manufacturer	Name	Compression ratio	ON
<b>SYM</b>	Excel II	9,7:1	≥ 95
	Attila Elizabeth	10,1:1	
	Attila Victoria	10,1:1	
	Enjoy	9,6:1	≥ 92
	Elegant	9,0:1	
	EZ 110	9,1:1	
<b>Piaggio</b>	Piaggio Carnaby	(12-12,5):1	≥ 95
	Vespa LX	(10,1 - 11,1):1	
	Vespa LXL	(10,6 + - 0,5):1	
	Vespa GTS	(12 - 13):1	
	Granturismo 125	(12 - 13):1	
<b>Suzuki</b>	X-bike 125	9,6:1	≥ 95
	Smash Revo	9,5:1	
	Hayate	9,6:1	



# GASOLINE QUALITY IN SOME ASIAN & MIDDLE EAST COUNTRIES

	INDONESIA			JAPAN		MALAYSIA		SOUTH KOREA		TAIWAN			THAILAND		VIETNAM		
	88	91	95	89	96	92	97	91	94	92	95	98	91	95	90	92	95
				JIS K2202		MS 118				CNS12614					TCVN 6776:2005		
	<b>Mar-06</b>			<b>Jan-05</b>		<b>2005</b>		<b>Jan-06</b>		<b>Jan-07</b>			<b>Jan-06</b>		<b>Jan-05</b>		
INDUCTION PERIOD						240				320			360		480		
SULFUR (mg/kg)	500			50/10(2007)		500		50		50			500		500		
OLEFINE (%V)	<20							18 OR 21		18			-		38		
BENZENE (%V)	-	5	5	1		5		1		1			3.5		2.5		
METALS (mg/l)	-	-	NIL							-			-		5		
AROMATIC S (%V)	-	50	40					30 OR 27		36			35		40		



# GASOLINE QUALITY IN SOME ASIAN & MIDDLE EAST COUNTRIES

SPECS	AUSTRALIA	BRUNEI	CHINA	BEIJING	H KONG	INDIA
	91 ↓ 95 ↓ 96	85 ↓ 92 ↓ 97	90 ↓ 93 ↓ 97	90 ↓ 93 ↓ 97	95	88 ↓ 93
		INDUSTRY LIMITS	GB 17930:2006	DB 11/238:2004		BHARAT II
	Jan-06	Oct-01	Dec-06	Jul-05	Jan-05	Apr-05
INDUCTION PERIOD			480			
SULFUR (mg/kg)	150	1000	500	150	50	500
OLEFINE (%V)	18		35	18 OR 25	18	
BENZENE (%V)	1	5	2.5	1	1	3
METALS (mg/l)						
AROMATICS (%V)	45		40	42 OR 35	35	



# DIEZEL QUALITY IN SOME ASIAN & MIDDLE EAST COUNTRIES

	Effect in	Sulphur	Cetane Index	Density	Distillation	Viscosity	Lubricity
Indonesia	Mar-06	3.500/50 0	48-45/51-48	815-870/820- 860	T95- 370max/360ma x	2.0-5.0/2.0- 4.5	/460
Japan	JIS K 2204 Jan-05	10	45/45	860max	T90-360 max	2.7 min	nomentione d
Malaysia	MS 123 Jun-05	3000	45/47	Report	T90-370 max	1.5-5.8	nomentione d
Philippine s	PNS 04:2003 Jan-04	500	48/48	860max	T90-370 max	2.0-4.5	460
Korea	Jan-06	30	45/45	815-845	T85- 360 max	1.5-5.5	460
Taiwan	Jan-05	50	/48	Report	T90-338max	1.9-4.1	460
Thailand	Oct-07	350	47/47	810-870	T90-357max	1.8-4.1	460
Srilanka	Jan-04	3000/500	46/49	820-860	T90-370 max		nomentione d
Vietnam	TCVN 5689:2005	2500/50 0	46	820-860	T90-360 max	2.0-4.5	460
Kuwait	ADO	2000	48	820-870	T95- 370max	2.0-5.0	nomentione d



# DIEZEL QUALITY IN SOME ASIAN & MIDDLE EAST COUNTRIES

	Effect In	Sulphur	Cetane Index	Density	Distillation	Viscosity	Lubricity
Australia	Jan-06	50	46/	820-850	T 95- 360 max	2.0-4.5	460
Brunei	Oct-01	1000		870max	T85- 350 max	1.6-4.8	No mentioned
China	GB 252:2000	2000	/45	Report	T95-365 max	3.0-8.0	No mentioned
Nonmandatory	GB/T19147:2003	500	46/49	820-860	T95- 355 max	3.0-8.0	460
Beijing	DB11/239:2004	350	46/51	820-845	T95-355max	3.0-8.0	460
India	Bharat I 4/1/2005	350	46/51	820-860	T95-max 370		460

Basing on fuel quality of above Asian & Middle East countries & octane number requirement of vehicles in Vietnam, the suggestions are following:

1. To loose the limits of some specs of gasoline & DO in Vietnamese Standards 2005

1.1. For gasoline :

No	Specifications	TCVN 6776: 2005	Suggestion
1	Induction period, minutes, min	480	240

**1.2. For diesel oil**

No	Specifications	TCVN 5689: 2005	Suggestion
1	<b>Distillation at 90% vol, oC, max</b>	<b>360</b>	<b>370</b>
2	<b>Viscosity at 40 DEG C, cSt</b>	<b>2 – 4,5</b>	<b>1,5 – 5,8</b>
3	<b>Density at 15 DEG C, kg/m<sup>3</sup></b>	<b>820 – 860</b>	<b>810 – 870</b>
4	<b>Lubricity, μm, max</b>	<b>460</b>	<b>Report</b>
5	<b>Particulate Contaminant, mg/l, max</b>	<b>10</b>	<b>Report</b>
6	<b>Water, mg/kg, max</b>	<b>200</b>	<b>0,05 % Vol</b>

## 2. More testing methods are applied in the standards:

### 2.1. For gasoline :

No	Specifications	Test Methods	
		TCVN 6776: 2005	Added Methods
1	<b>Lead content</b>	<b>TCVN 7143:2002 (ASTM D3237)</b>	<b>ASTM D5059</b>
2	<b>Sulfur content</b>	<b>TCVN 6701:2000 (ASTM D2622)/ D5453</b>	<b>ASTM D4294, D3120</b>
3	<b>Aromatic content</b>	<b>TCVN 7330:2003 (ASTM D1319)</b>	<b>ASTM D5580</b>
4	<b>Benzene content</b>	<b>TCVN 6703:2000 (ASTM D3606)/ D4420</b>	<b>ASTM D5580/ D6293,</b>
			<b>Reject D4420</b>
5	<b>Olefine content</b>	<b>TCVN 7330:2003 (ASTM D1319)</b>	<b>ASTM D6296</b>
6	<b>RVP @37.8oC</b>	<b>TCVN 7023:2002 (ASTM D4953)/ D5191</b>	<b>ASTM D323</b>

## 2.2. For diesel oil :

No	Specifications	Test Methods	
		<b>TCVN 5689: 2005</b>	<b>Added Methods</b>
1	<b>Water</b>	<b>TCVN E203</b>	<b>ASTM D6304/ D95</b>
2	<b>Particulate Contaminant</b>	<b>ASTM D2276</b>	<b>ASTM D6217</b>
3	<b>Pour Point</b>	<b>TCVN 3753:1995/ ASTM D97</b>	<b>ASTM D5950</b>
4	<b>Sulfur content</b>	<b>TCVN 6701:2000 (ASTM D2622)/ D5453</b>	<b>ASTM D4294</b>

- 3. Future steps for fuel quality in Vietnam :**
  - 3.1. Phasing out RON 83 gasoline now.**
  - 3.2. Using only one grade diesel oil 500 ppm sulphur up to now.**
  - 3.3. Implementing EURO 3 in 2012.**
  - 3.4. In 2012 upgrading Gasoline with RON 90, 92,95 to RON 92, 95,97.**



THANK YOU