

IEEJ : June 2006



Northeast Asia Refining Industry Outlook

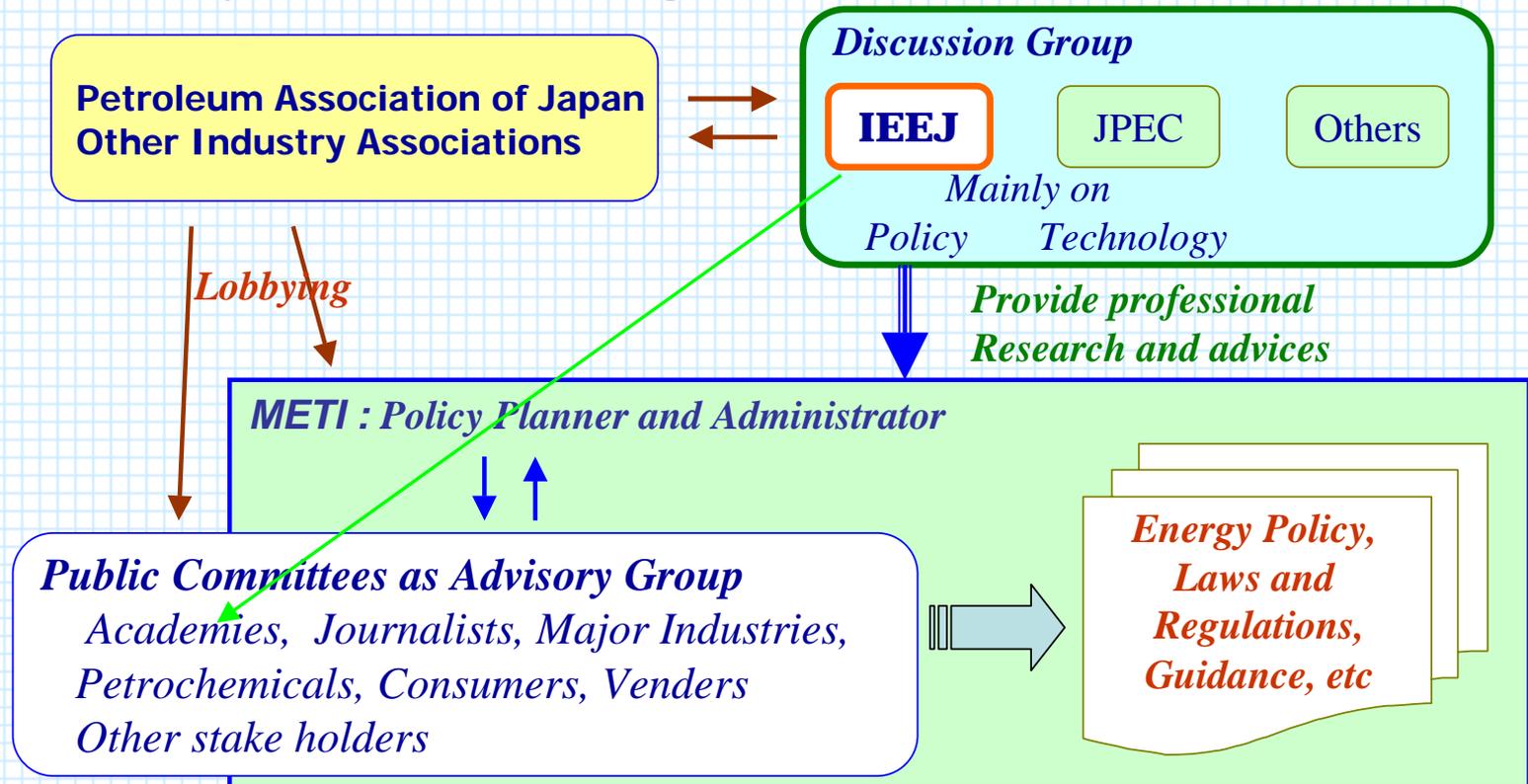
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Gist of this paper was presented at recent occasions such as The 7th China Oil Traders' Conference (18-20 April 2006 in Nanjing China) and China Oil & Gas Dialogue 2006 (23-24 May 2006, Beijing China)

Who is IEEJ (日本能源經濟研究所)

IEEJ is a Research Institute with over 100 prominent industry sponsors, crafting Japan's petroleum policies.



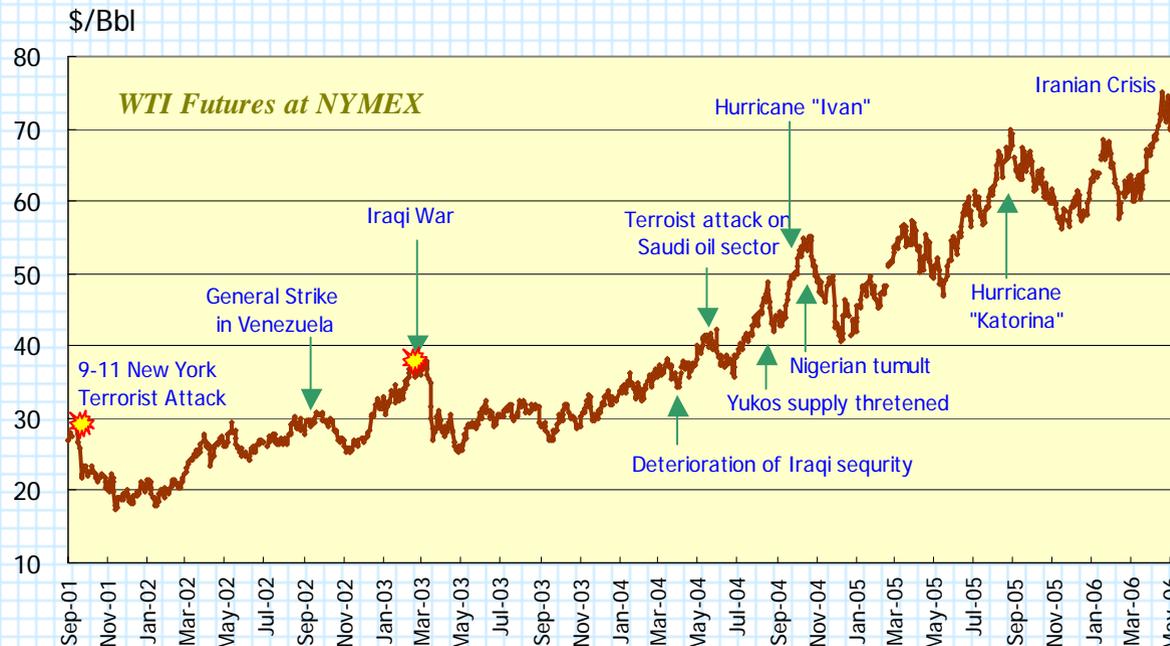
1.1 Oil Price Skyrocketing

1. Strong demand surge

US plus Emerging economies(China, India, Brazil)

2. Shrinkage of surplus supply capacity in upstream, downstream and US gas & power market.

3. Speculation by money funds.



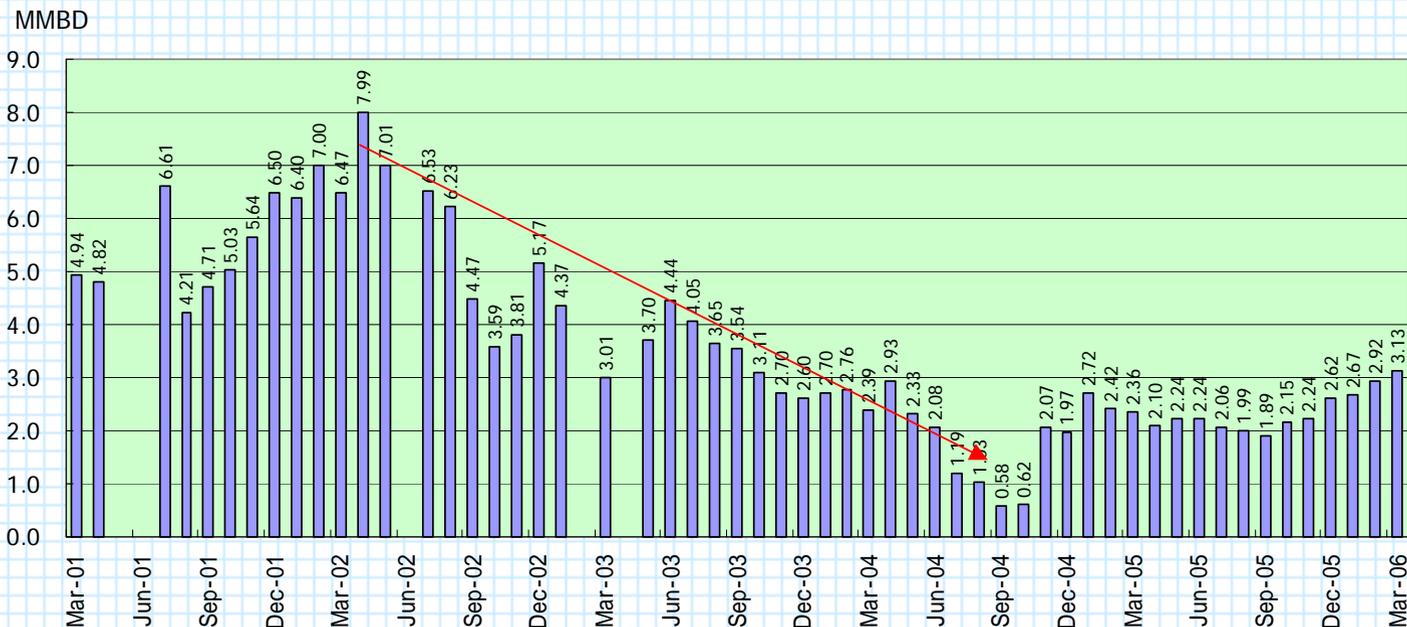
1.2 OPEC Surplus Capacity

1. OPEC surplus supply capacity decreased sharply toward autumn of 2004.

Iraqi production was slow to recover.

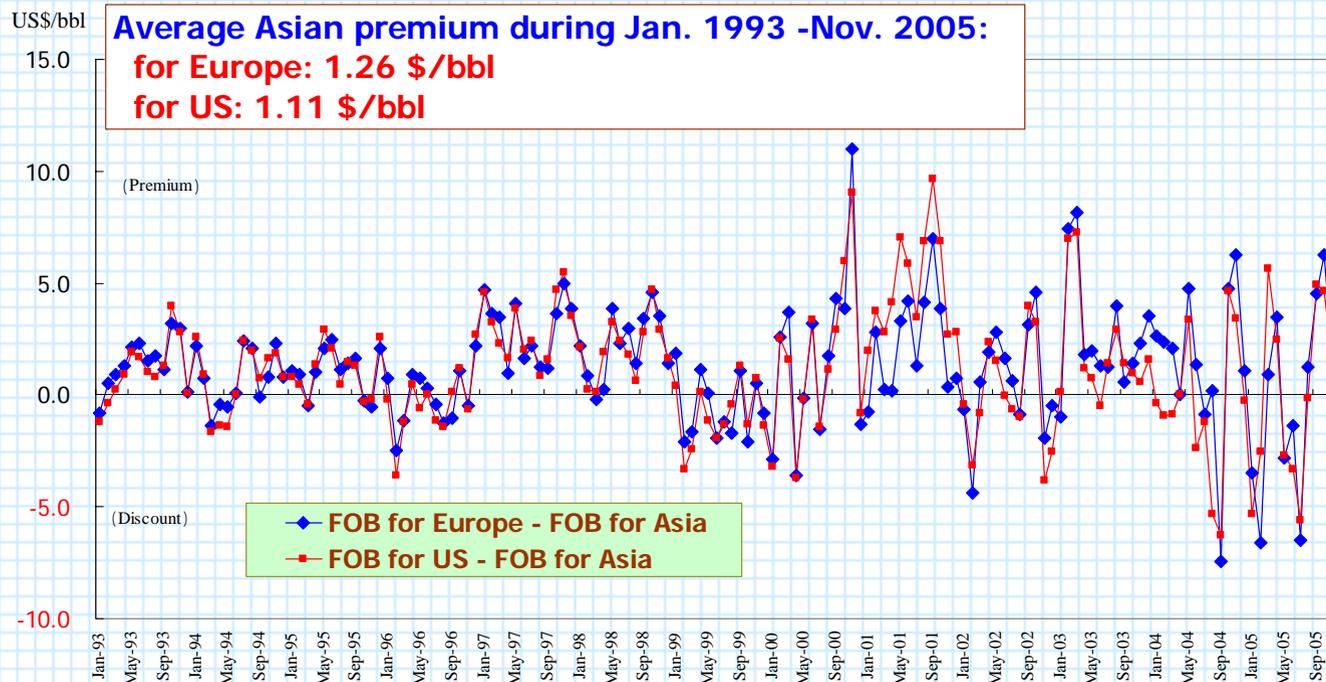
2. Material/services supply are in short at sudden boom.

3. Exploration opportunities are closed to foreign Investment.



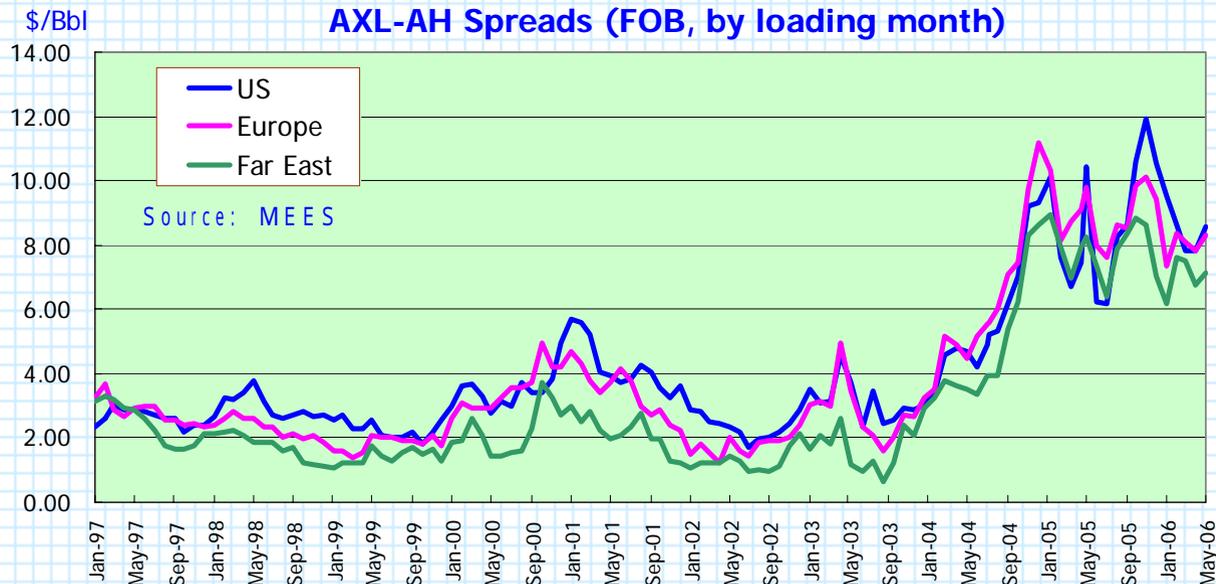
1.3 Asian Premium of ME Crude

1. The Middle East crude oils have been priced more than \$1/Bbl higher for destination Asia.
2. Asian Premium may prevail as far as strong demand continues without influential alternative sources.



1.4 Light-Heavy Spread of Oil Price

1. Quality differential between light and heavy crude oils may be in the range of \$2-4/Bbl technically.
2. The spread expanded abnormally reflects lack of upgrading capacity.
 >> **Cracking, desulfurization, hydro-treating etc.**

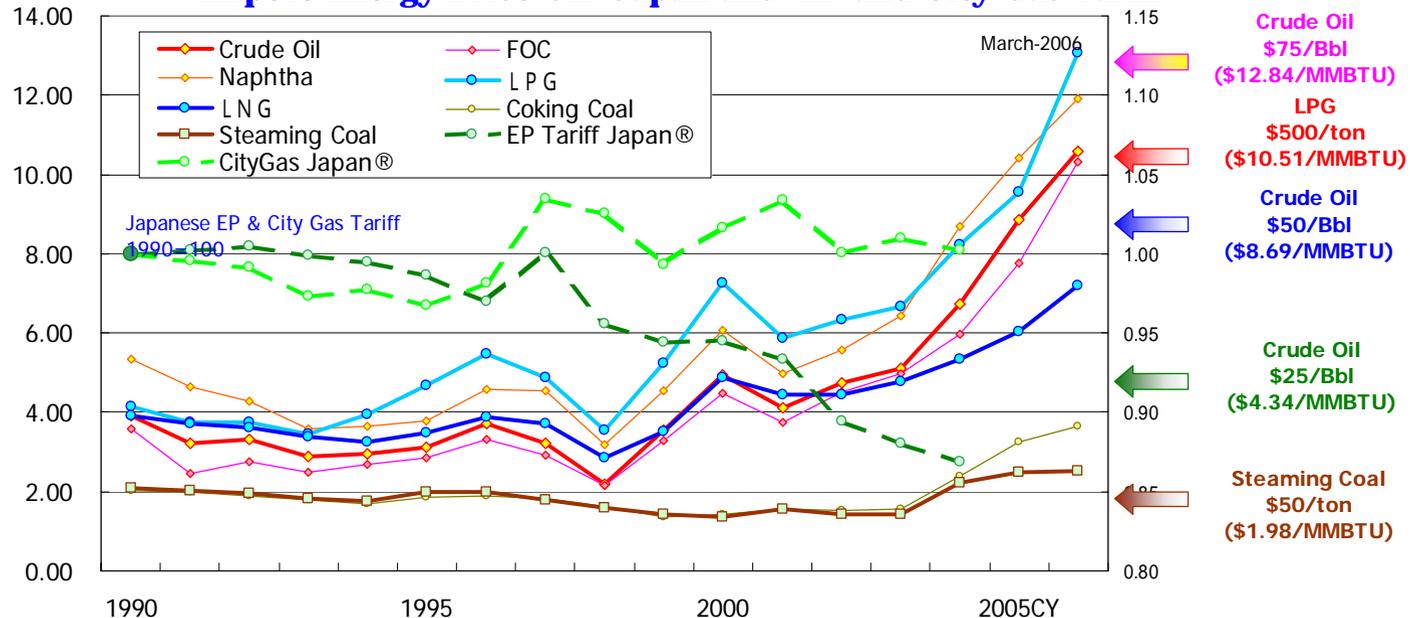


1.5 Era of High Energy Price

1. Oil price has surpassed LNG price : the gap is widening.
2. Coal price is going up, but still absolutely low.
3. Electricity tariff has decreased reflecting slow investment, though it would rebound sooner or later.

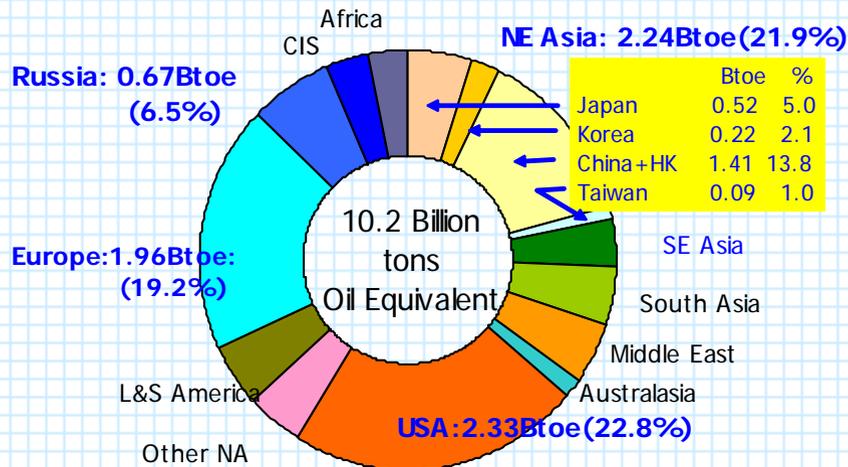
\$/MMBTU

Import Energy Price CIF Japan and EP and City Gas Tariff



2.1 Asia in the World

1. Northeast Asia is one of the three major energy markets of the world together with North America and Europe.
2. Asian energy consumption is expanding rapidly driven by the fast growth of China.
 - a. Stable energy supply is an important policy objective of Asia
 - b. Northeast Asia will be a golden market of the 21st century



Source: BP Statistical Review of World Energy 2005

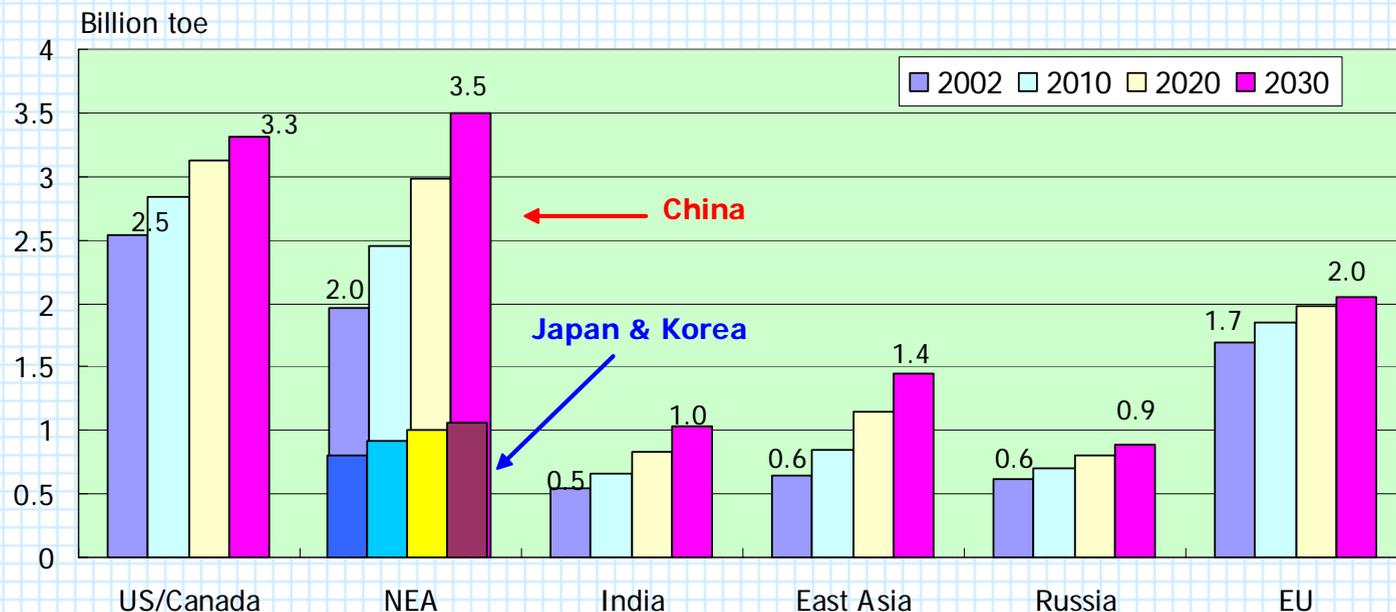
	Energy Total		Oil Equiv. Growth	
	Btoe	%	Btoe	%
China	14.1	+15.1		
India	3.8	+7.2		
Other Asia	17.6	+4.4		
US, Europe, Others	66.8	+2.1		
World	102.2	+4.3		

Oil		
	Btoe	%
China	3.2	+15.5
India	1.2	+5.5
Other Asia	5.1	+4.7
US, Europe, Others	28.2	+1.9
World	37.7	+3.4

2.2 Energy Outlook of Asia

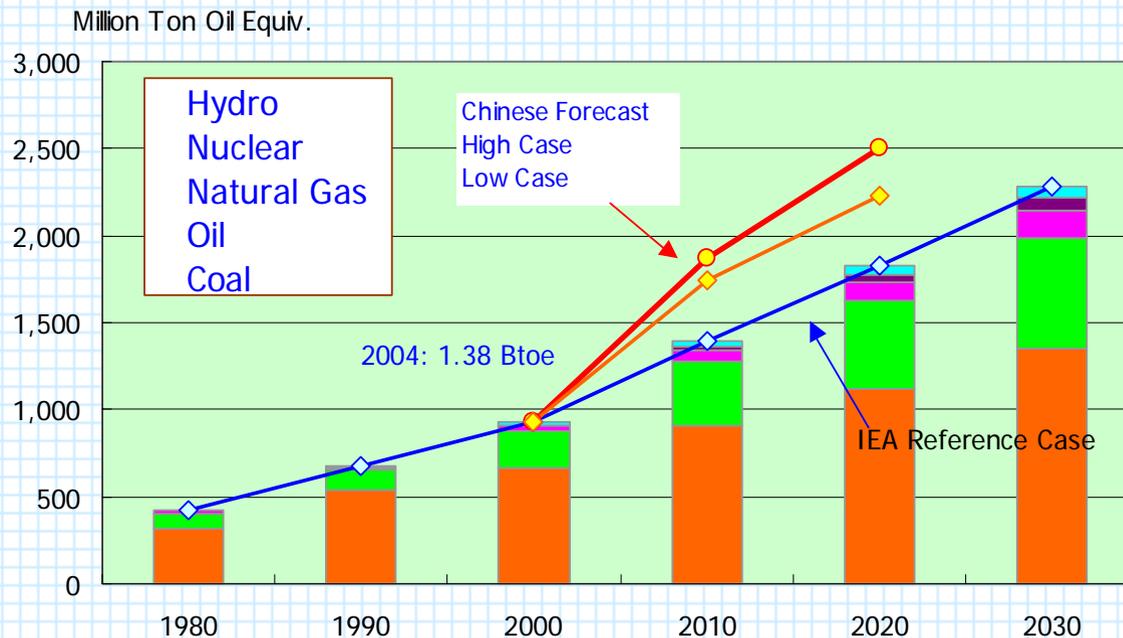
IEA World Energy Outlook 2004

1. Energy consumption of Northeast Asia is expected to grow fast, exceeding north America in 2020s.
2. China's energy consumption will increase substantially, while those of Japan and Korea remain moderate.



2.3 Energy Outlook of China

1. IEA's projection, based on 2002 actual, considerably undershoots the recent trend.
2. China's energy demand may reach 2.0 - 2.5 billion tons in 2020.



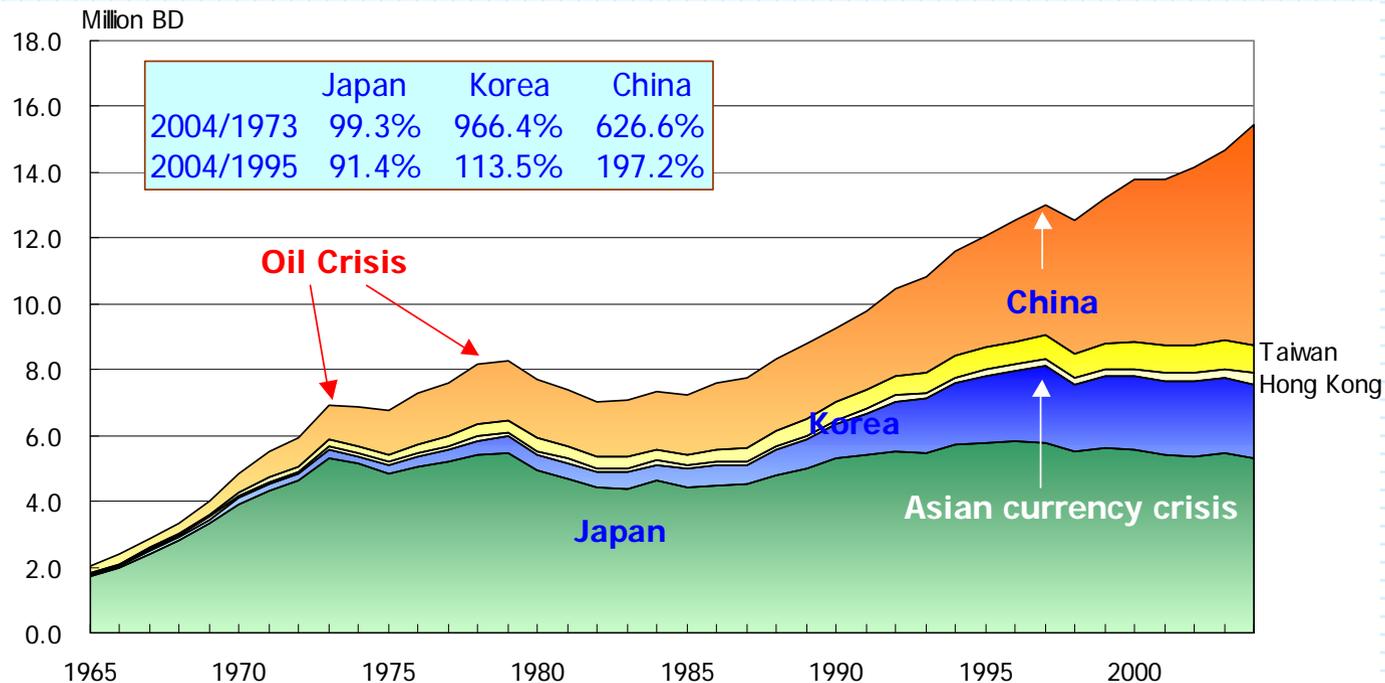
3.1 Petroleum Demand of NE Asia



Japan: Oil demand is on a declining trend

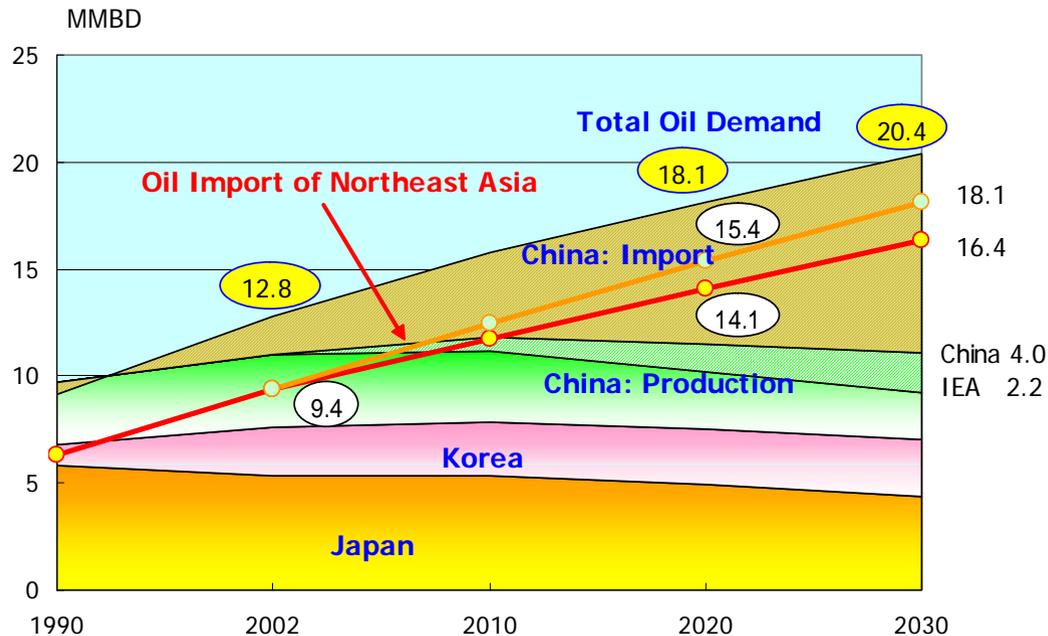
Korea: Oil demand grows modestly as economy matures.

China: Oil demand is increasing vigorously while domestic production is leveling-off.



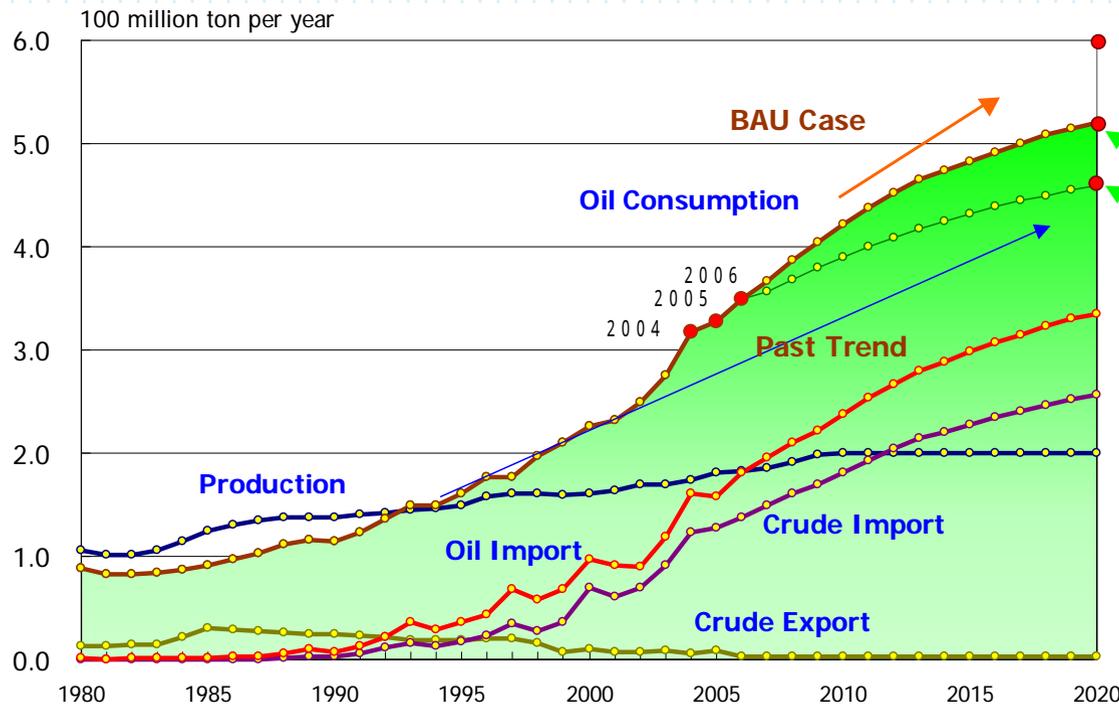
3.2 Petroleum Outlook of NE Asia

- Oil consumption of Northeast Asia (13 MMBD in 2005) will increase more than 5 MMBD by 2020.**
- Since China's domestic production would be more or less leveling off, oil import will also increase by 5 MMBD.**



3.3 Petroleum Outlook of China

1. China's oil demand will continue rapid growth.
2. As existing large fields are depleting, China's oil production will be leveling off. Oil import will increase substantially.
3. Refining capacity needs expansion and upgrading.



BAU Case
(IEEJ)
590MMT

IEA Scenarios 2004		
	2020	2030
	MMt	MMt
Reference	503	636
Alternative	464	559

GDP Growth Rate	
1971-2002	8.4%
2002-2010	6.4%
2010-2020	4.9%
2020-2030	4.0%

3.4 Refinery Capacity of NE Asia

1. Refinery Capacity (2004: 12.9 MMBD)

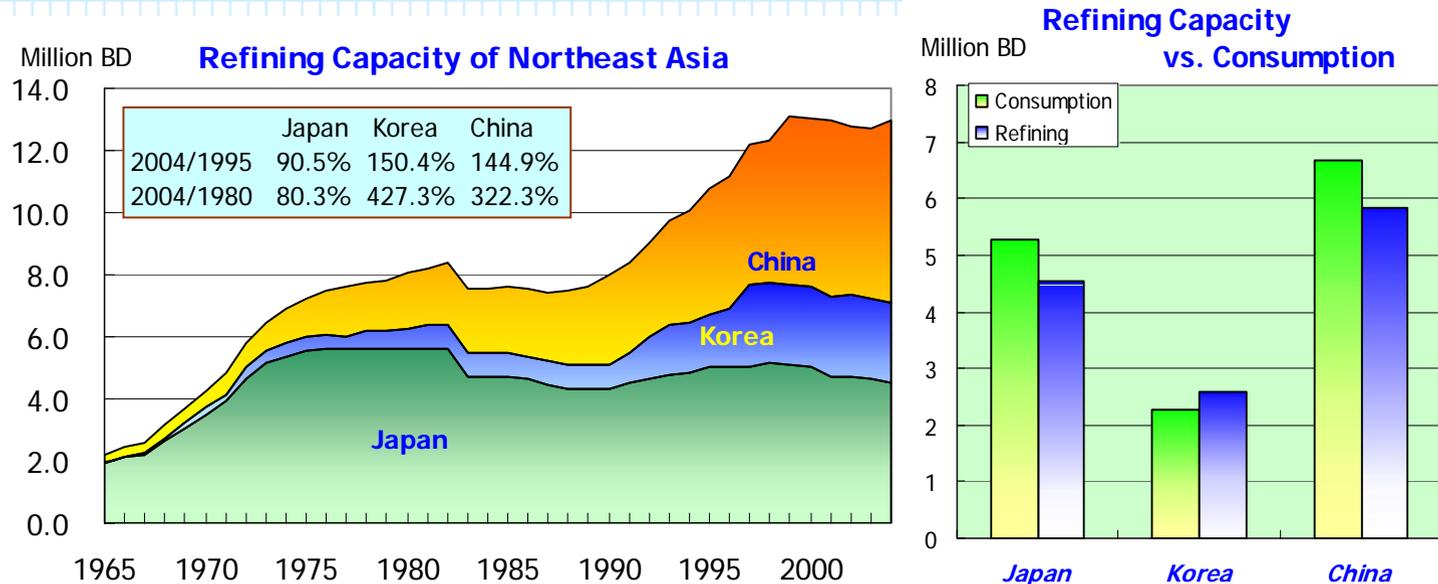
Japan: reduced since the second oil crisis.

Korea: increased substantially in the 1990s.

China: increased but not catching up demand growth

2. Petroleum Product Balance

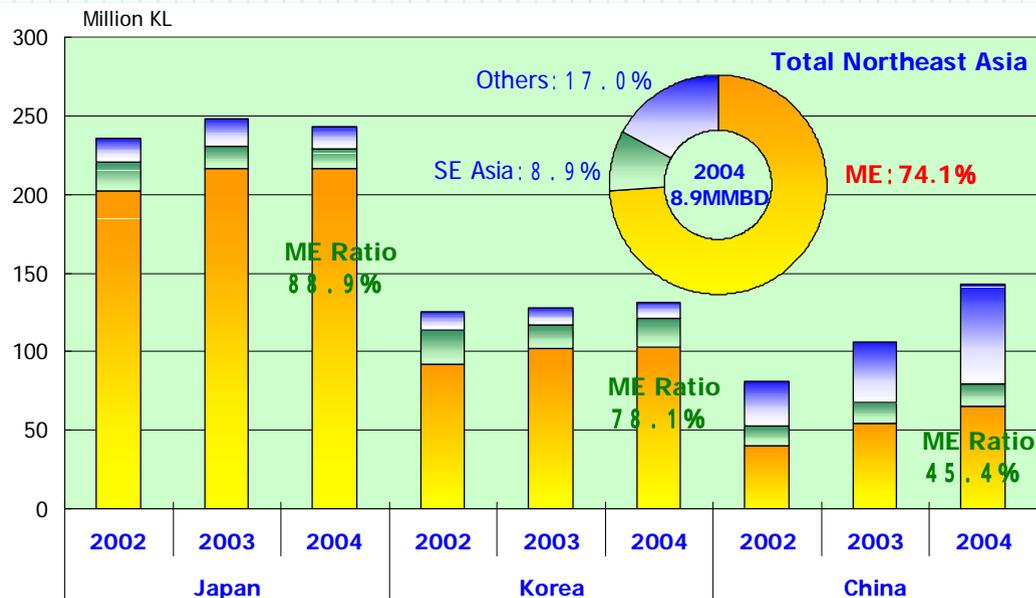
Japan and China: import position vs. Korea: export position



Source: BP Statistical Review of World Energy

3.5 Middle East Dependency of Oil

1. Northeast Asia depends on the Middle East 3/4 of oil Import
2. Though China's ME ratio is below 50%, it would inevitably go up as the absolute import quantity increases.
3. Refiners are required to prepare for high-sulfur crude oil from the Middle East and heavy oil from Canada/Venezuela.



Source: National statistics

3.6 Facts and Concerns

Facts

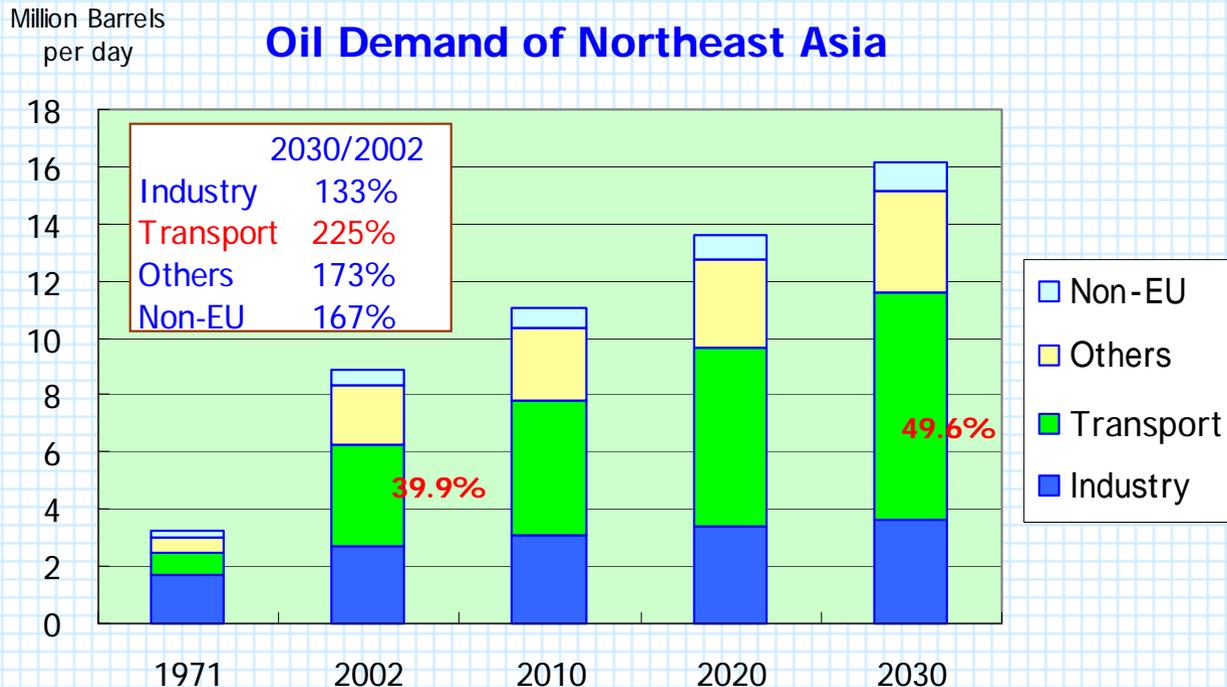
1. Petroleum demand of Northeast Asia will increase 5 MMBD by 2020 mainly in China, while it is declining in Japan.
2. Incremental crude oil for processing must be imported, increasing input of heavier and high sulfur crude.
x China would inevitably increase the ME dependence.
3. Light-heavy price differential among crude oils has been widening, enabling expensive counter measures.

Concerns

1. Refining capacity should be expanded to satisfy demand.
2. Refineries should prepare for increase of imported crude.
x Deep-water ports to receive very large tankers (VLCC)
x Sophisticated facilities for cracking and desulfurization
x Oil stock piling against import disruptions

4.1 Petroleum Demand Structure

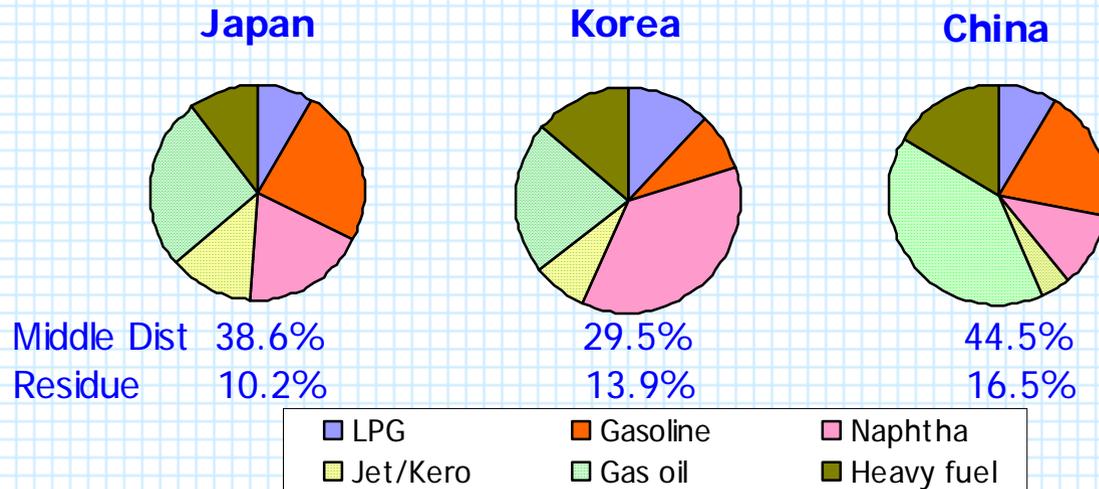
1. IEA forecasts that petroleum demand on Northeast Asia will increase mainly in transport sector.
2. This tendency may be enhanced by diversified energy price increases.



4.2 Heavy Fuel being driven out

1. Share of heavy fuel oil is less than 20% in Northeast Asian market.
2. With higher oil prices driven by rise of transport fuel demand, heavy fuel oil demand shall be further eroded giving way to natural gas, coal and nuclear.

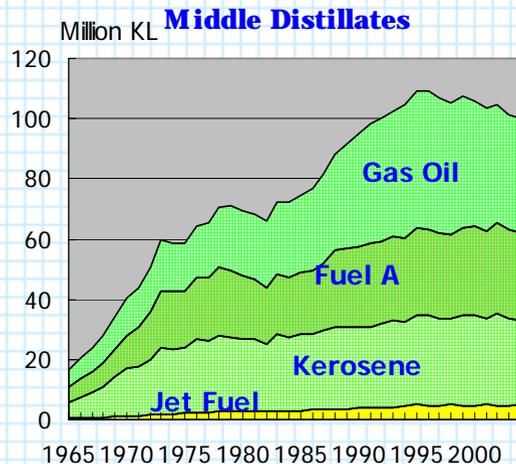
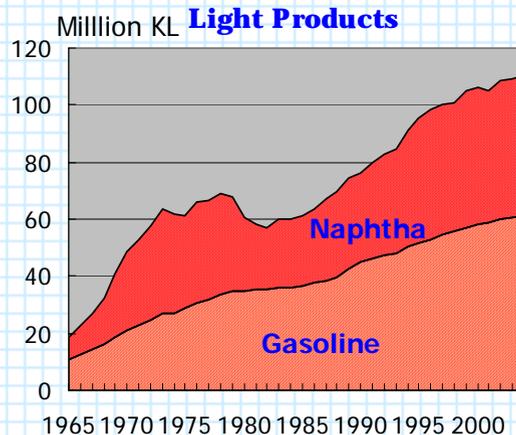
→Oil based IPPs, once burgeoned, are now burdens!



4.3 Demand Trends among Products

Japanese oil demand is on a declining trend. Among others,

1. Heavy fuel oil demand is decreasing faster. Especially, oil based IPPs are being knocked down.
2. Light products (gasoline & naphtha) demand is relatively steady.
3. Middle distillates demand is turning downward.
 - 1) Energy conservation campaign in freighter business.
 - 2) Inferior price competition in heating sector.

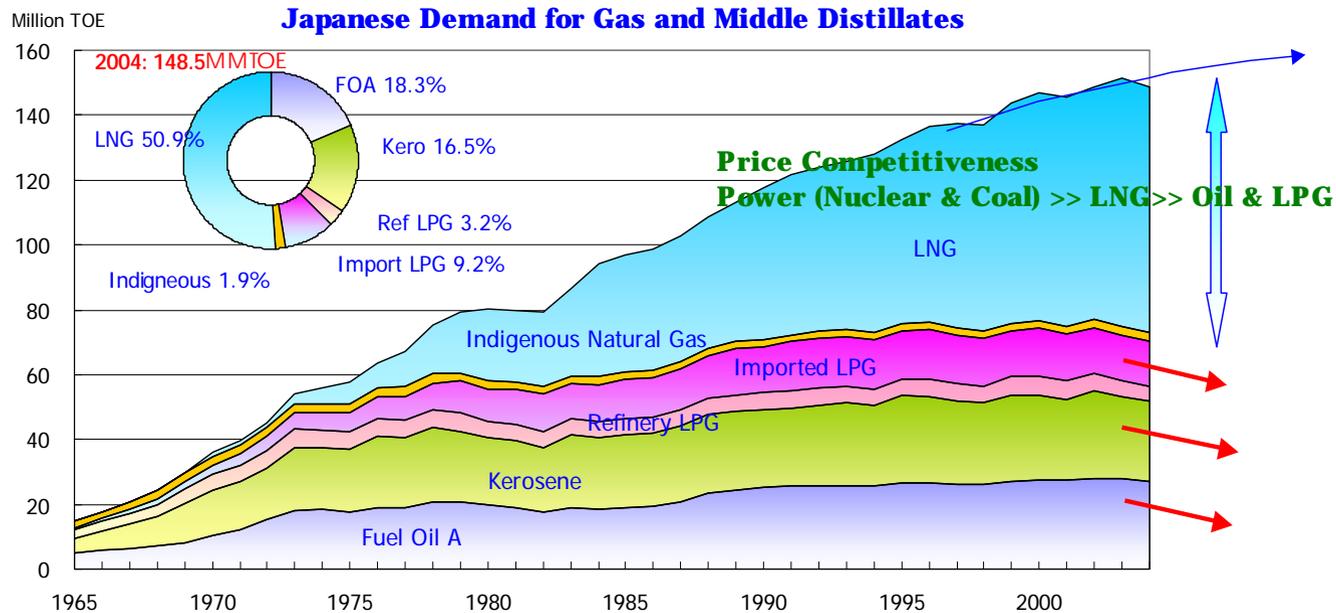


4.4 Middle Distillates being driven out

Higher energy price will

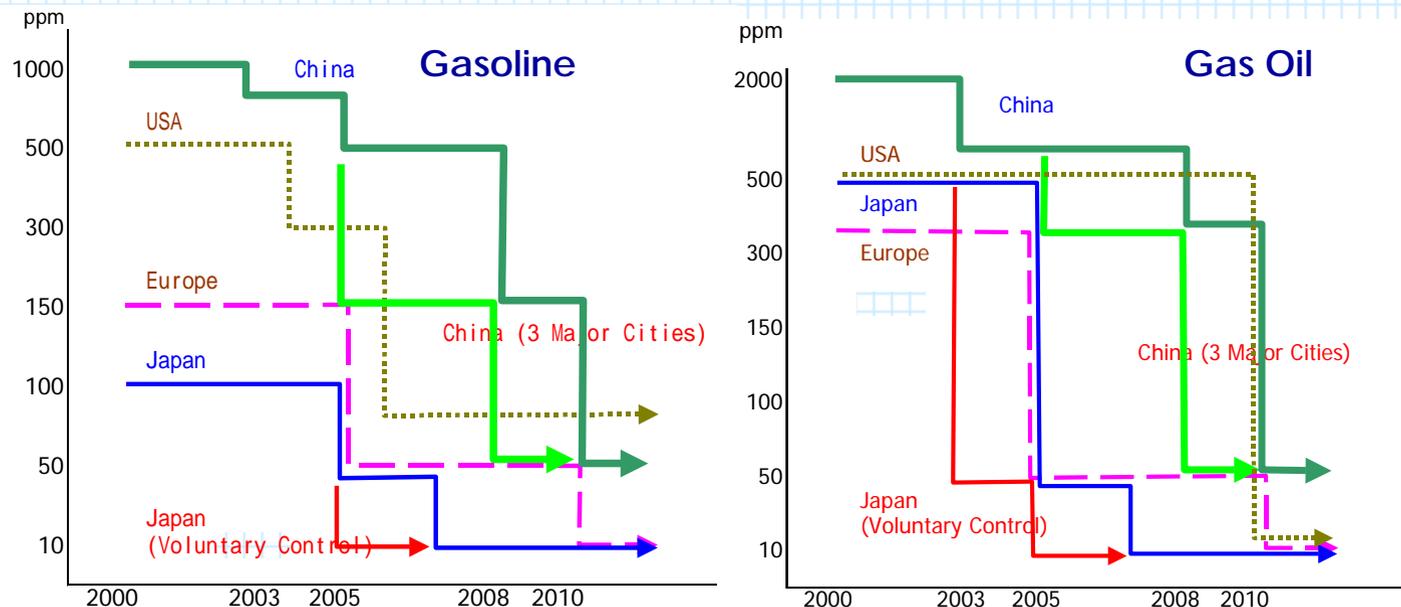
1. Enhance energy conservation in general.
2. Intensify price competition among fuel sources outside the transportation sector.

Power (coal & nuclear) >> Natural Gas
>> LPG & Middle Distillates



4.5 Motor Fuel Quality Regulation

1. The Japanese oil industry realized “Sulfur Free(<10ppm)” for both gasoline and gas oil as of January 1, 2005.
2. With worsening metropolitan environment, China is going to improve motor fuel quality abruptly.



4.6 Refining Facility: China/Japan

1. In China, cost effective cracking methods such as FCC are mainly used.
2. Desulfurization and hydro-treating capacity is extremely small, which are necessary to upgrade motor fuel quality.

	China	Japan
	1000BD	1000BD
Topping Unit	4528	4897
Vacuum Distillation	40	1708
Coking/ Residue Cracking	306	147
FCC	892	966
Reformer	157	782
Hydro Cracking	122	143
Hydro Treating / Desulfurization	355	4622
	%	%
Cracking Ratio	29.2	25.6
Desulfurization Ratio	7.8	94.4
Reforming Ratio	3.5	16.0

4.7 Challenges: Asia and Japan

1. Issues for Asia

- 1) **Petroleum demand in China and India will grow fast.
Securing stable oil product supply is essential for sustainable development.**
- 2) **Improving motor fuel quality is urgent environmental requirement.**
→ Huge investment and sophisticated technologies!!

2. Issues for Japan

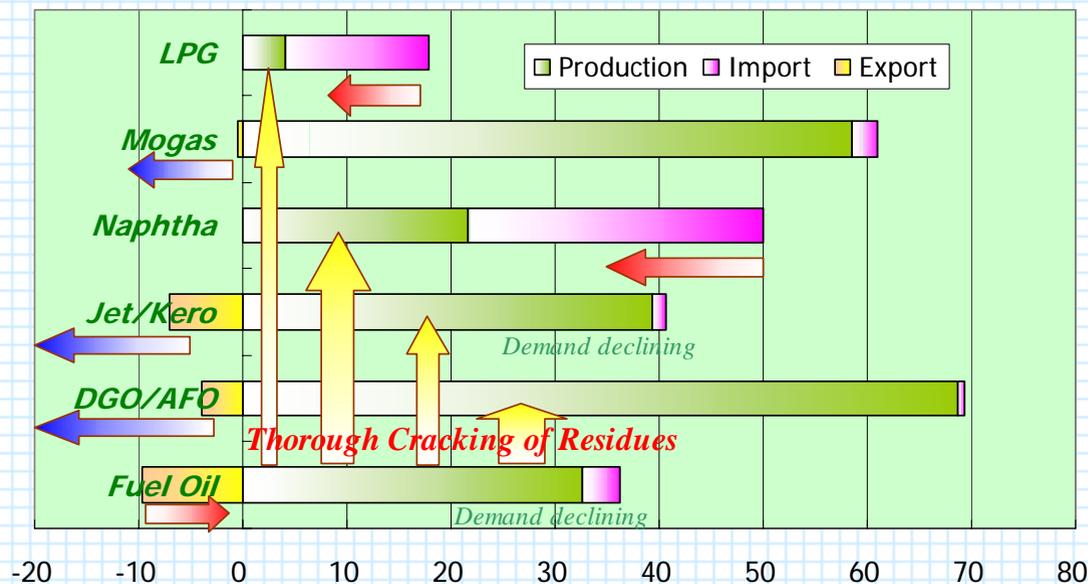
- 1) **Total demand continues to decline**
Heavy fuel oil & IPP use: declines fast
Middle distillates: continues to decline
- 2) **Core demand : Transport Fuel and Petrochemical Feedstock**
→ Increasing idle capacities
→ Thorough cracking of residue
→ Excessive supply of middle distillates

5.1 Product Supply Structure

Cracking the residue thoroughly shall result in:

1. Decrease of LPG and Naphtha import
2. Increase of Middle Distillates export
3. Decrease of Heavy Fuel export for deeper processing

Japan's Product Supply Structure (2005): Million KL



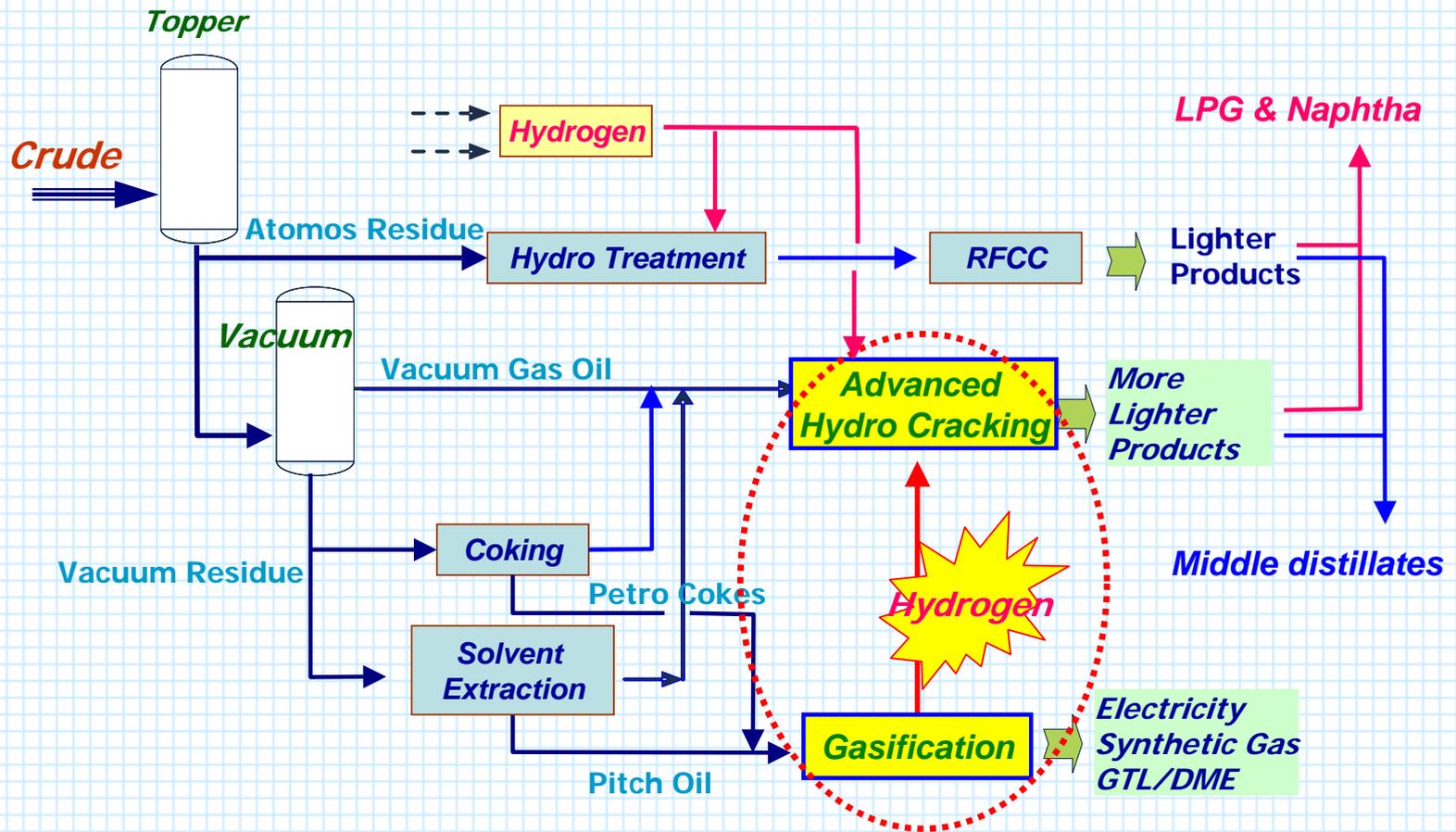
5.2 Refining Business Trend

1. **Oil demand will converge to lighter products**
 - Noble use of conventional oil
 - Reflecting price spread among energy sources subject to difficulties of producing light petroleum products (ex. GTL, Coal liquefaction, bio-diesel, etc.)

2. **More FCC with advanced hydro treating will be introduced**
 - FCC gasoline
 - Olefins for petrochemicals
 - Middle distillates with wide range of property (ex. Sulfur content, Cetane number, Viscosity, etc.)

3. **In the Asian market, wide range of middle distillates will become available from Japan and Korea. This will**
 - Mitigate investment requirements in emerging market
 - Require standardized grades for smart trading
 - Require segregated tanks for handling

5.3 Advanced Residue Conversion



5.4 Noble Use of Middle Distillates

1. **Deep cracking of residue**, reflecting petroleum product demand tendency, **will produce wide range of middle distillates with different characteristics.**
2. **Minimizing quality give-away** after costly cracking, standard specifications should be defined corresponding to quality groups.
3. Two or three standard grades may be set. For example,
 - 1) **High quality diesel** for high speed motor vehicles.
Extra LS (50ppm max) and high cetane number (50+)
 - 2) **Regular gas oil** for low duty engines.
Regular sulfur (500ppm max) and cetane number (45+)
 - 3) **Heating oil: Low sulfur but low cetane number**

**Thank you
for
your kind attention**

The Institute of Energy Economics, Japan

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