Changing Landscape of LNG Business in the APEC Region

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Yonghun Jung, Ph.D
Vice President
Asia Pacific Energy Research Centre, Tokyo

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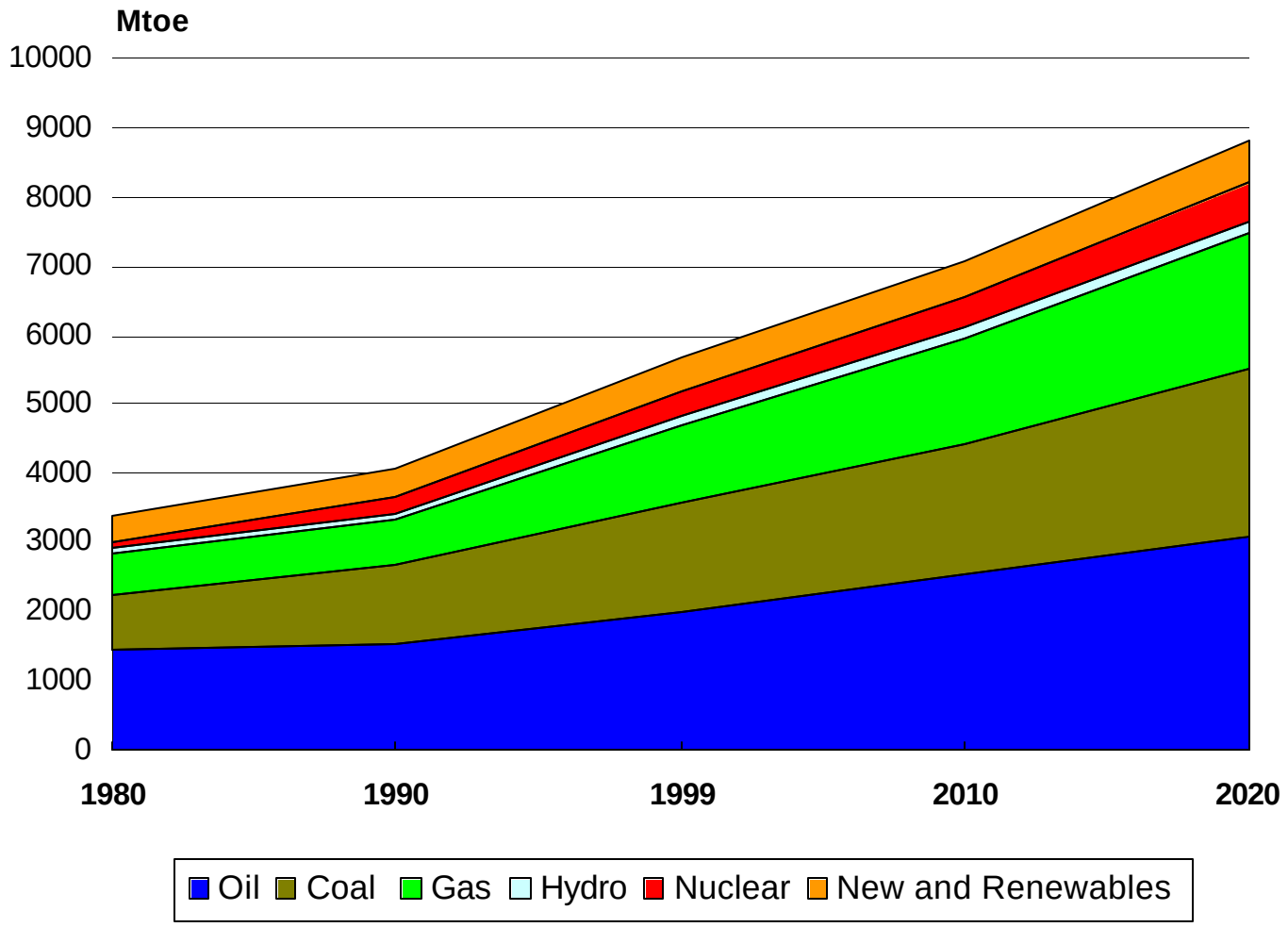
Total Primary Energy Supply in APEC (1980-2020)

TPES growing at an annual rate of 2.1 percent (1999-2020)



NRE 1.1 % p.a.

Nuclear 1.7 % p.a.

Hydro 2.7 % p.a.

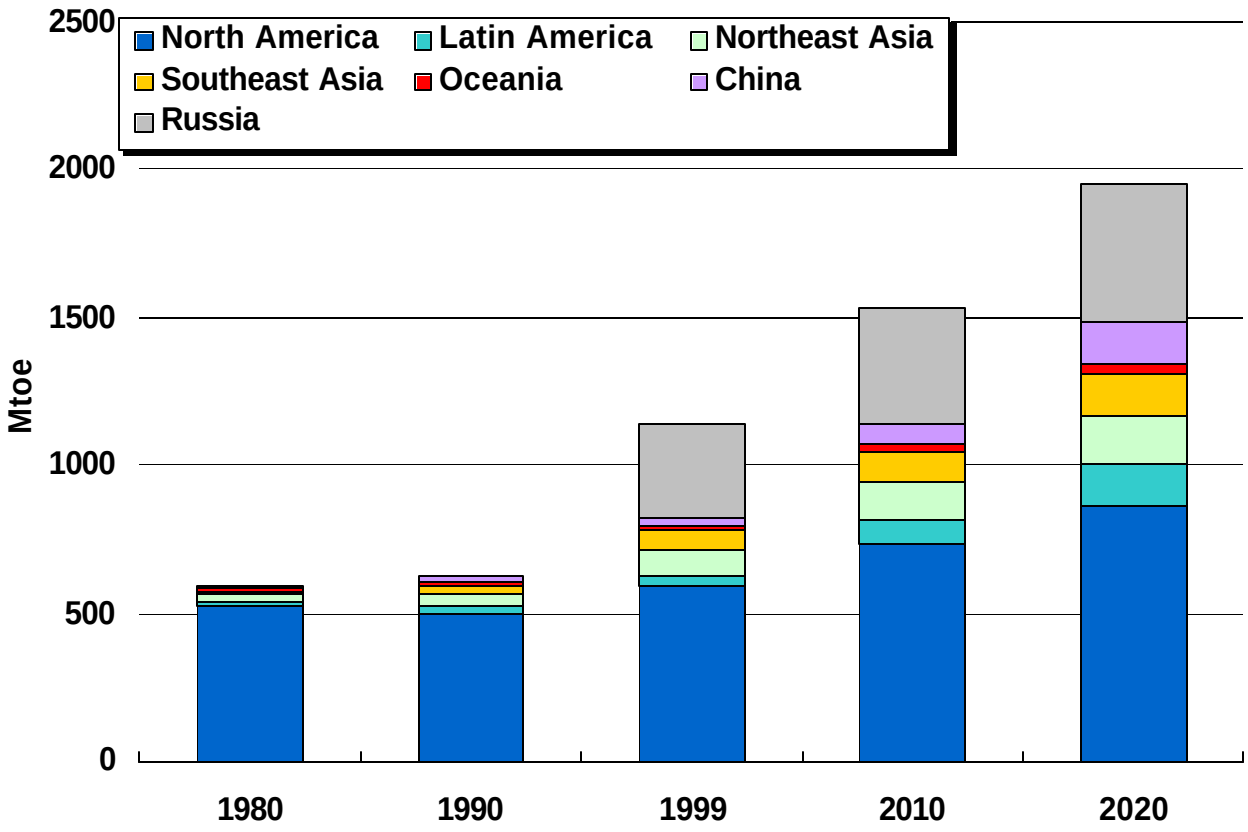
Natural Gas 2.6 % p.a

Coal 2.1% p.a.

Oil 2.1% p.a.

Source: APERC (2002), "APEC Energy Demand and Supply Outlook 2002"

Outlook for Natural Gas by Region (1980-2020)



Annual Growth Rate of Natural Gas by Region

	1980-1999	1999-2020
Russia		2.0%
China	4.2%	**8.3%**
Oceania	5.6%	2.6%
Southeast Asia	10.7%	3.9%
Northeast Asia	7.2%	3.3%
Latin America	3.1%	**6.3%**
North America	0.7%	1.8%

Source: APERC (2002), "APEC Energy Demand and Supply Outlook 2002"

Note: IEA data for Viet Nam is available from 1986 onwards and Russian data is available from 1992 onwards, hence these are respectively included from 1990 and 1999 onwards.

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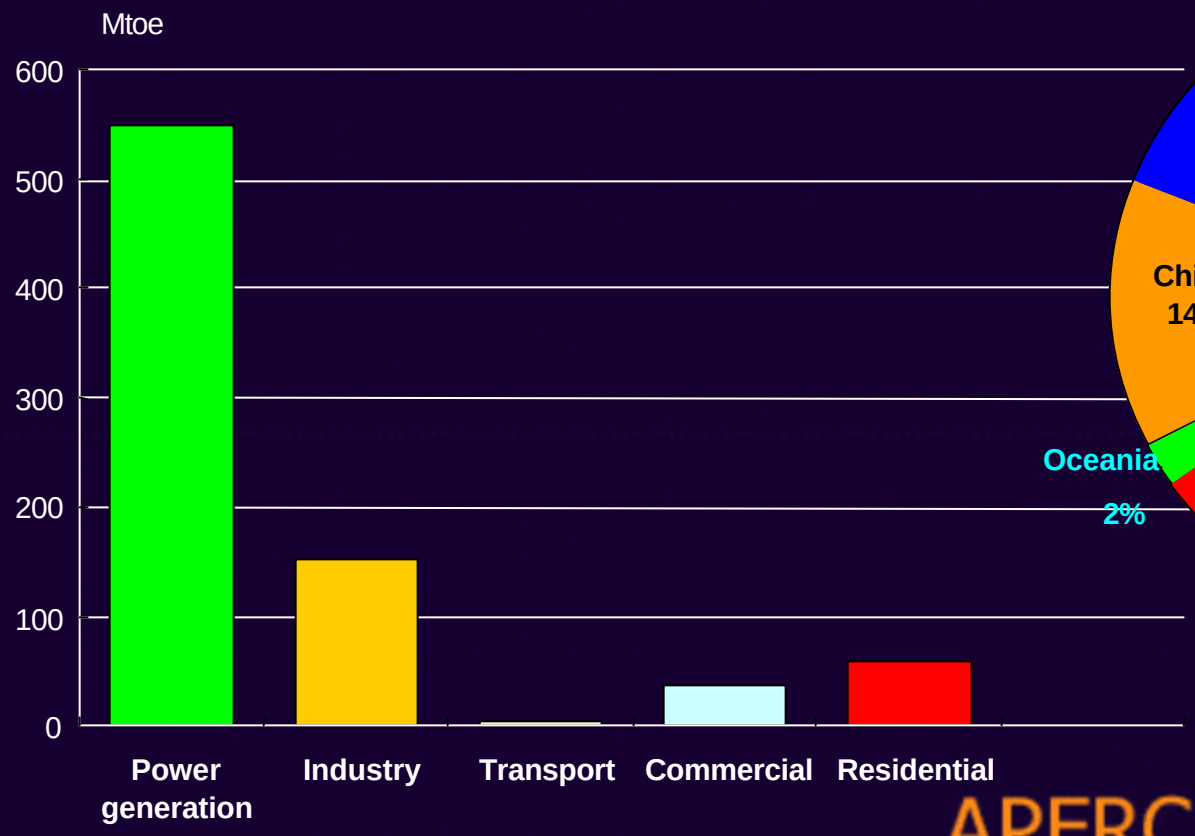
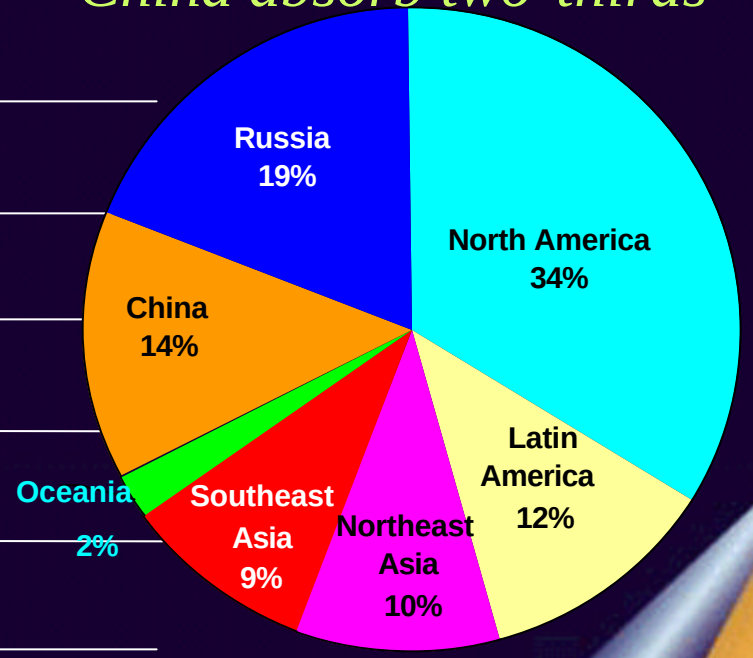
Natural Gas: Incremental Growth by Sector and Region (1999-2020)

Power sector will drive natural gas demand growth



North America, Russia and China absorb two-thirds



Source: APERC (2002), "APEC Energy Demand and Supply Outlook 2002"

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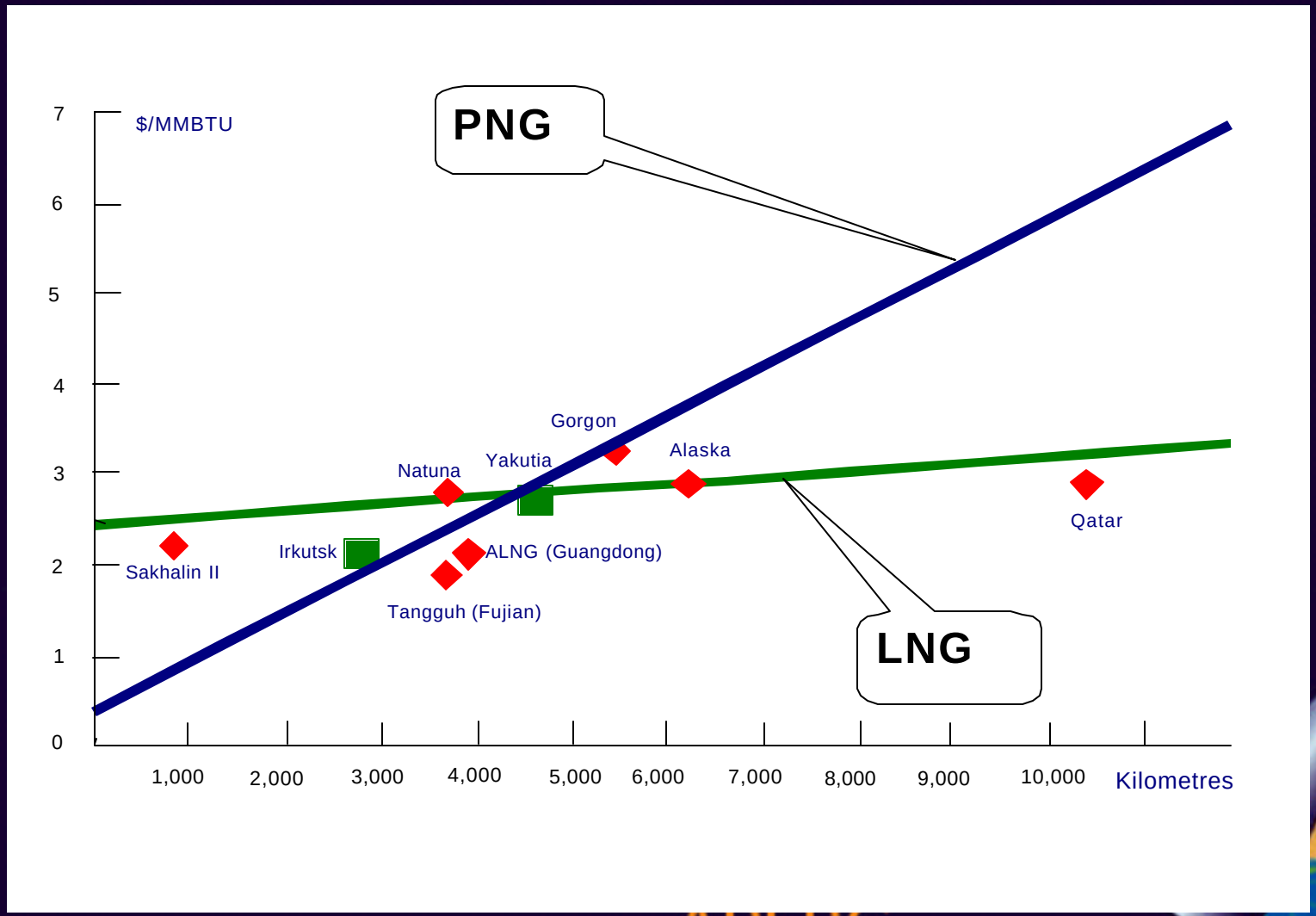
Why Natural Gas?

- Easy to use
- Clean
  - Neither SOx, nor NOx
  - Urbanization
- Mature market
  - Competitive price
  - Many sellers and many buyers

Two Modes of Transportation

- LNG (Liquefied Natural Gas) and PNG (Pipeline Natural Gas)
- Determining Factors
  - Distance, Volume and Destination (Blue Stream Project)
- LNG: Popular and preferred choice
  - Strong gas demand in ever growing power sector
  - LNG is growing more rapidly due to the relative cost reduction, abundant supply, mature technology, and increasingly flexible contract terms and conditions

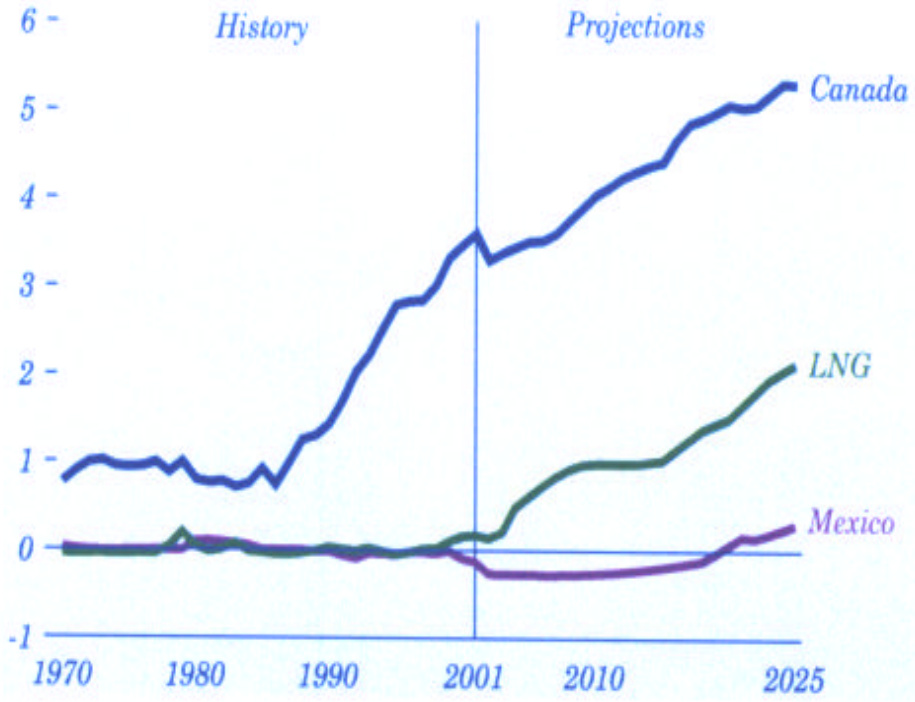
Transportation Costs by Types of Natural Gas Trade



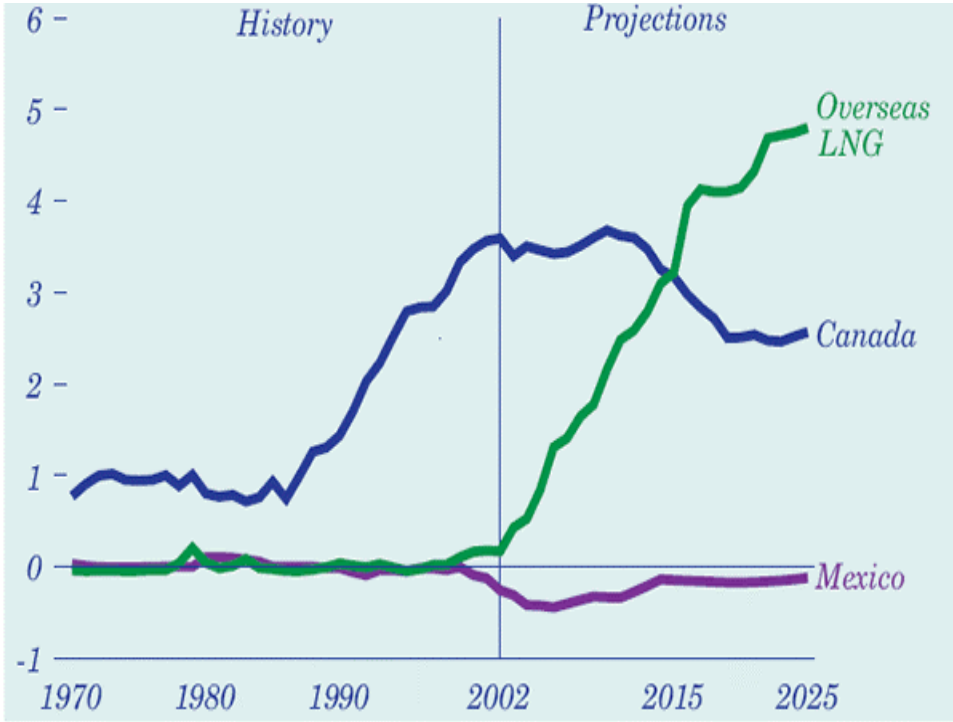
Source: APERC (2000), "Natural Gas Infrastructure Development in Northeast Asia"

US Net Imports of Natural Gas, 1970-2025 (trillion cubic feet)

Annual Energy Outlook 2003



Annual Energy Outlook 2004



Source: Energy Information Administration (2003) and (2004), "Annual Energy Outlook 2003" and "Annual Energy Outlook 2004"

Outlook of LNG for APEC

Expansion of LNG use in new locations (China, the Philippines, USA) is in sight.

		USA (EIA 04)	Japan (APERC)	Korea (APERC)	China (APERC)	Chinese Taipei (APERC)	Phillipines (APERC)	Total
2002	millon ton	4.2	54.5	17		5.6		81
	share in total gas	1%	97%	100%		94%		
2010	million ton	46.2	62	26	16	9.5		160
	share in total gas	8%	98%	100%	30%	91%		
2020	million ton	86.94	69	37	56	16.7	1.9	268
	share in total gas	14%	100%	100%	51%	95%	36%	

Source: APERC (2002), "Energy Demand and Supply Outlook 2002" and

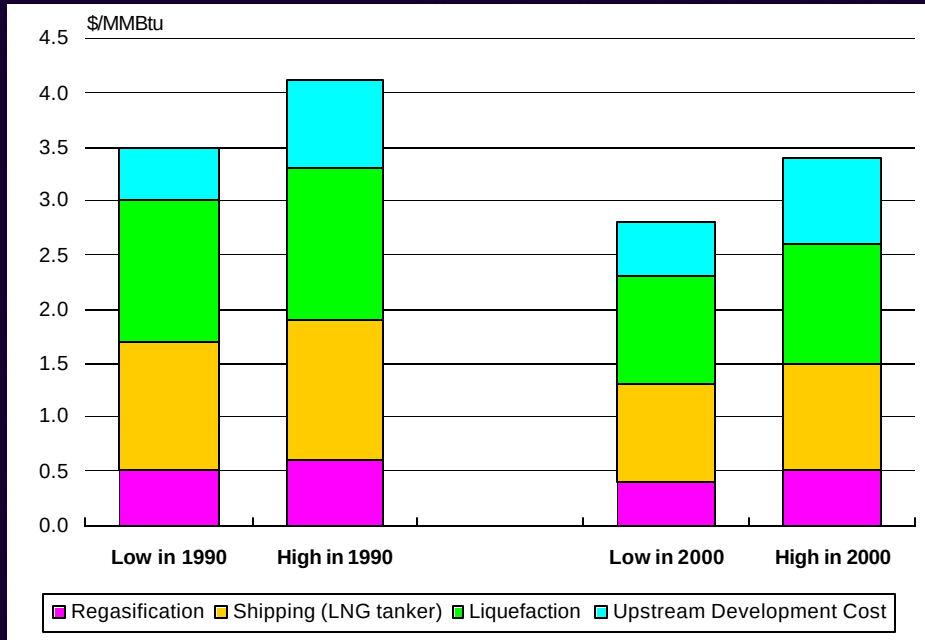
Energy Information Administration (2004), "Annual Energy Outlook 2004"

LNG Developments

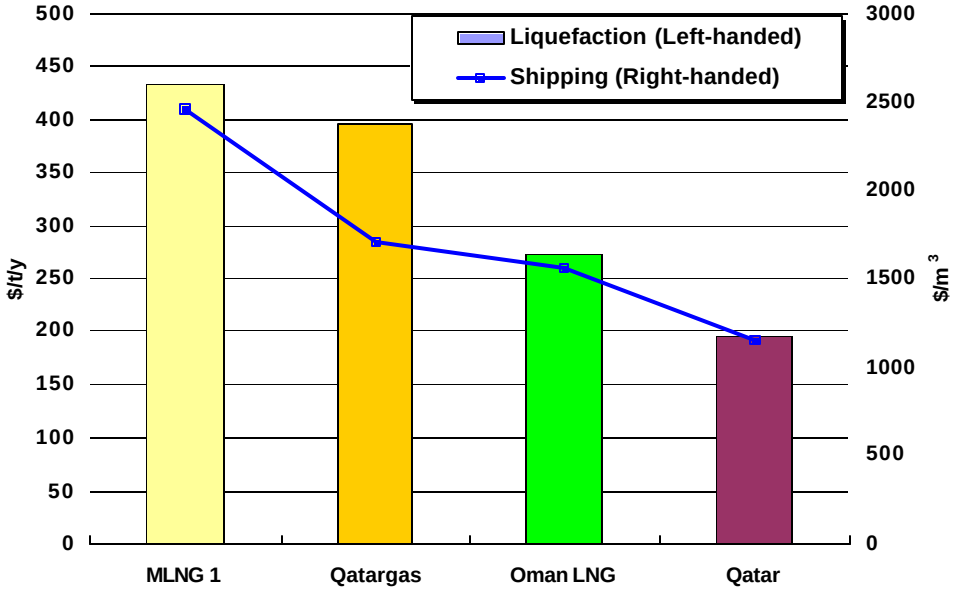
- Supply
  - Abundant supply
    - Lots of green projects, significant debottlenecking potential, and new suppliers in the horizon
  - Significant cost reduction
    - In all stages of fuel chain including liquefaction, transportation, and re-gasification
- Demand
  - Robust growth
    - Power sector in China

LNG Supply Cost Reduction

Technology development and improvement in operation helped reduce the total supply cost.



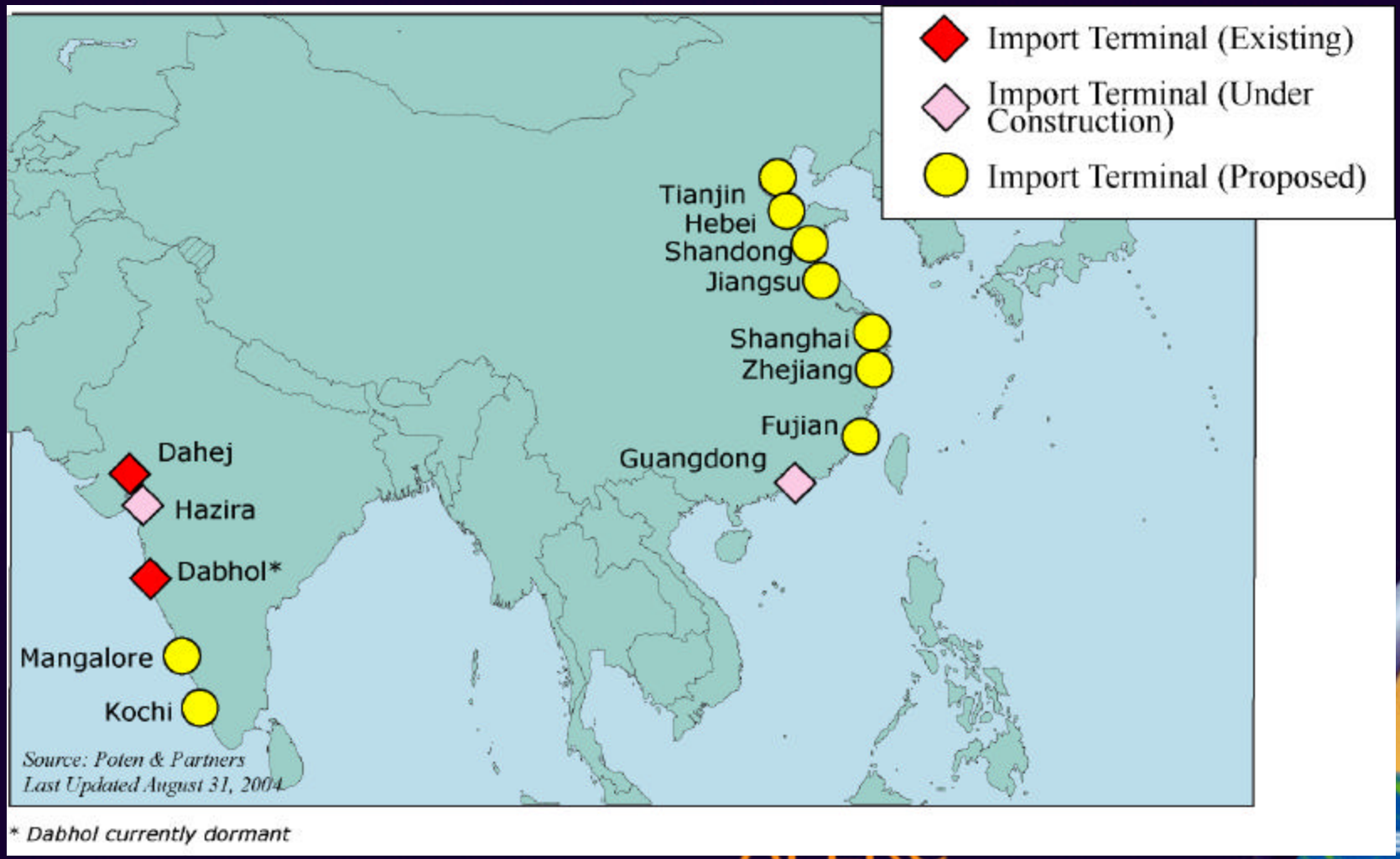
Source: CEDIGAZ



Source: Recreated from the data available at Poten & Partners website

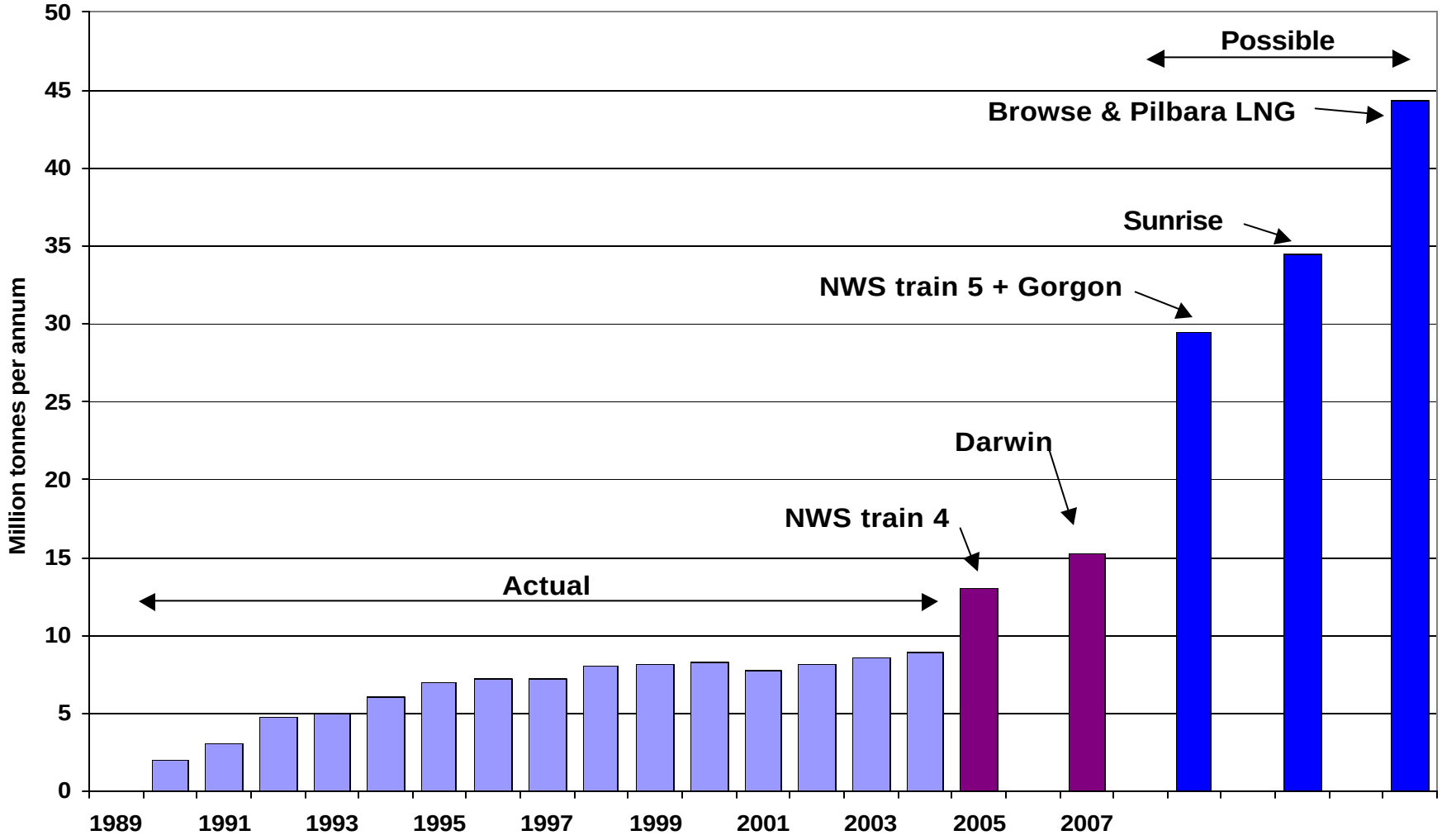
Note: MLNG1: 1983 grass-roots, Qatargas: 1996 grass-roots, Oman LNG: 2000 grass-roots, Qatar: 2000 expansion

Existing and Proposed LNG Receiving Terminals in China and India



Source: Spadine (2004) "LNG comes of age", a paper presented at the APERC's mid-year workshop 2004

LNG Supply from Australia



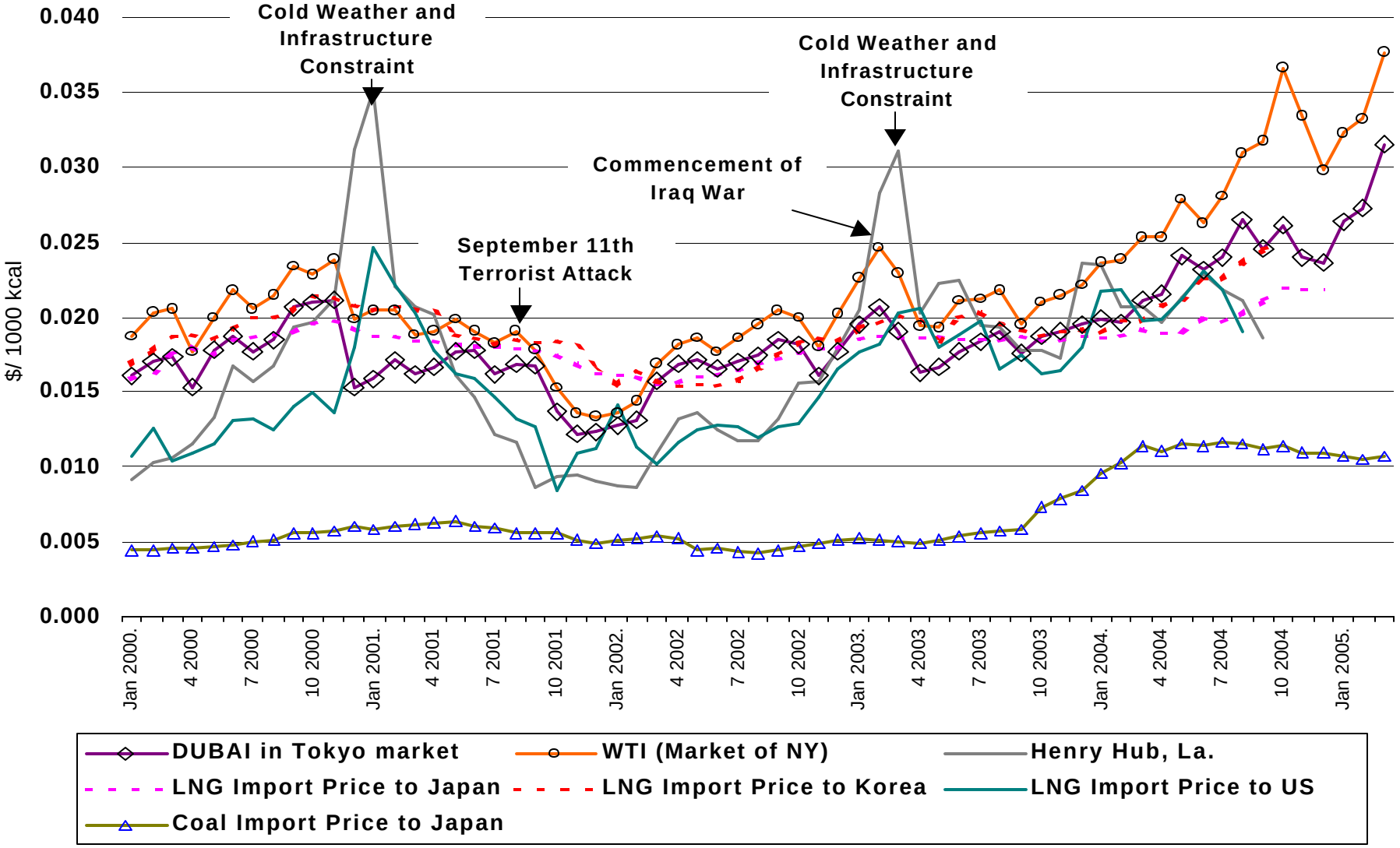
Source: Stone (2005), "Australian LNG Supply", a paper presented at the APEC LNG workshop, March 2005

Flexibility in LNG Contracts

- Shorter duration
- Price flexibility
  - Evolution of pricing
    - Cost Plus ? Crude Oil Parity, Petroleum Product Price Indexation ? Electricity Price Parity ?
  - Stable price regime
    - Price floor/ceiling
    - Decoupling with crude oil price
- Volume flexibility
  - DQT/UQT ? 10%~ 20%
- Periodical price review

Monthly Natural Gas Price Movements

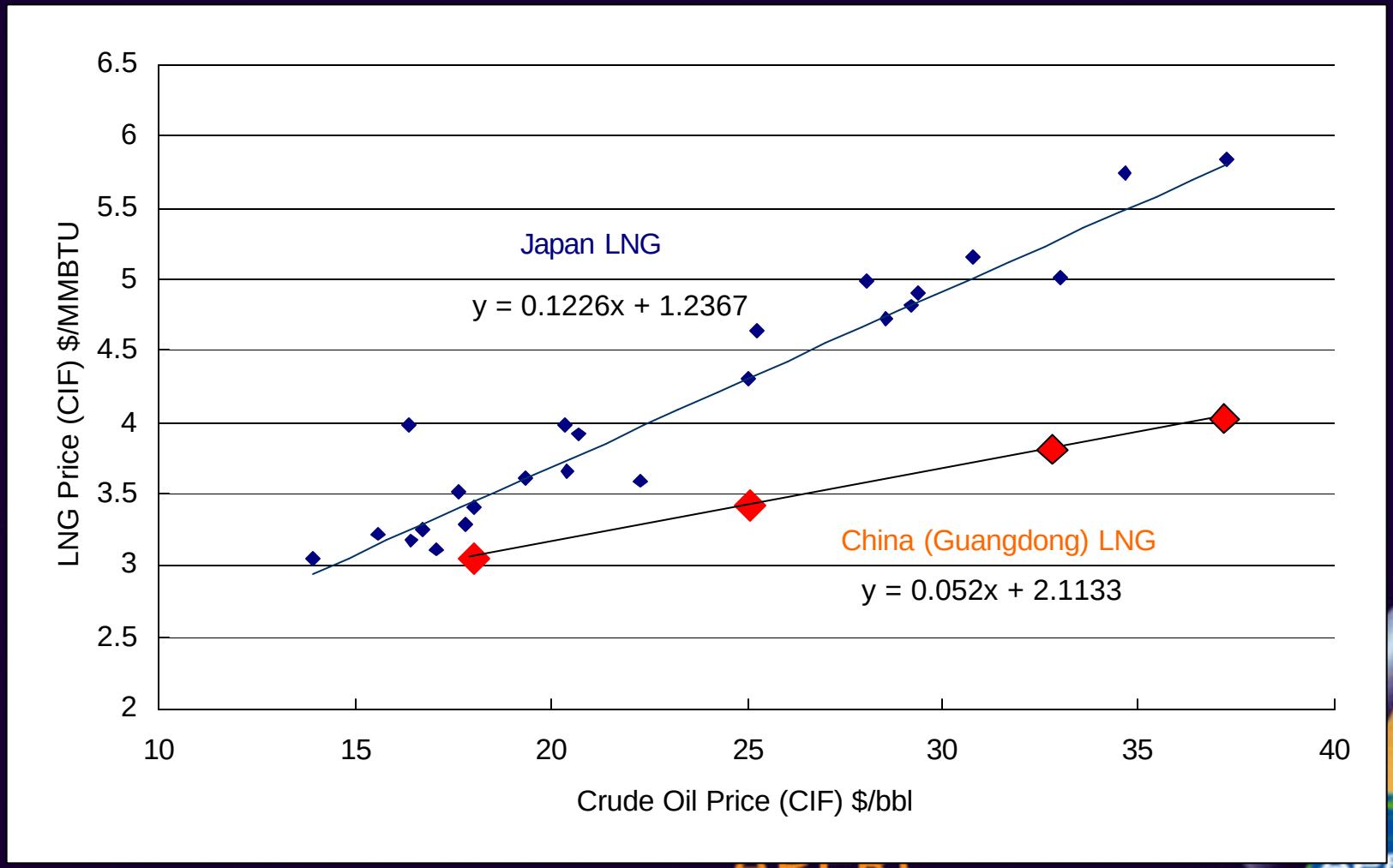
in Japan, Korea, Europe and USA (2000-Jan.2005)



Source: APERC Analysis (2005)

Correlation between LNG Price and Crude Oil Price (1980-2003)

Decoupling with crude oil price?



Source: APERC Analysis (2004) based on data from IEA (2004), "Energy Prices and Taxes" for LNG price, EDMC Database (2002) for Crude Oil Price, and Guangdong data was estimated by Petrostrategies (2002).

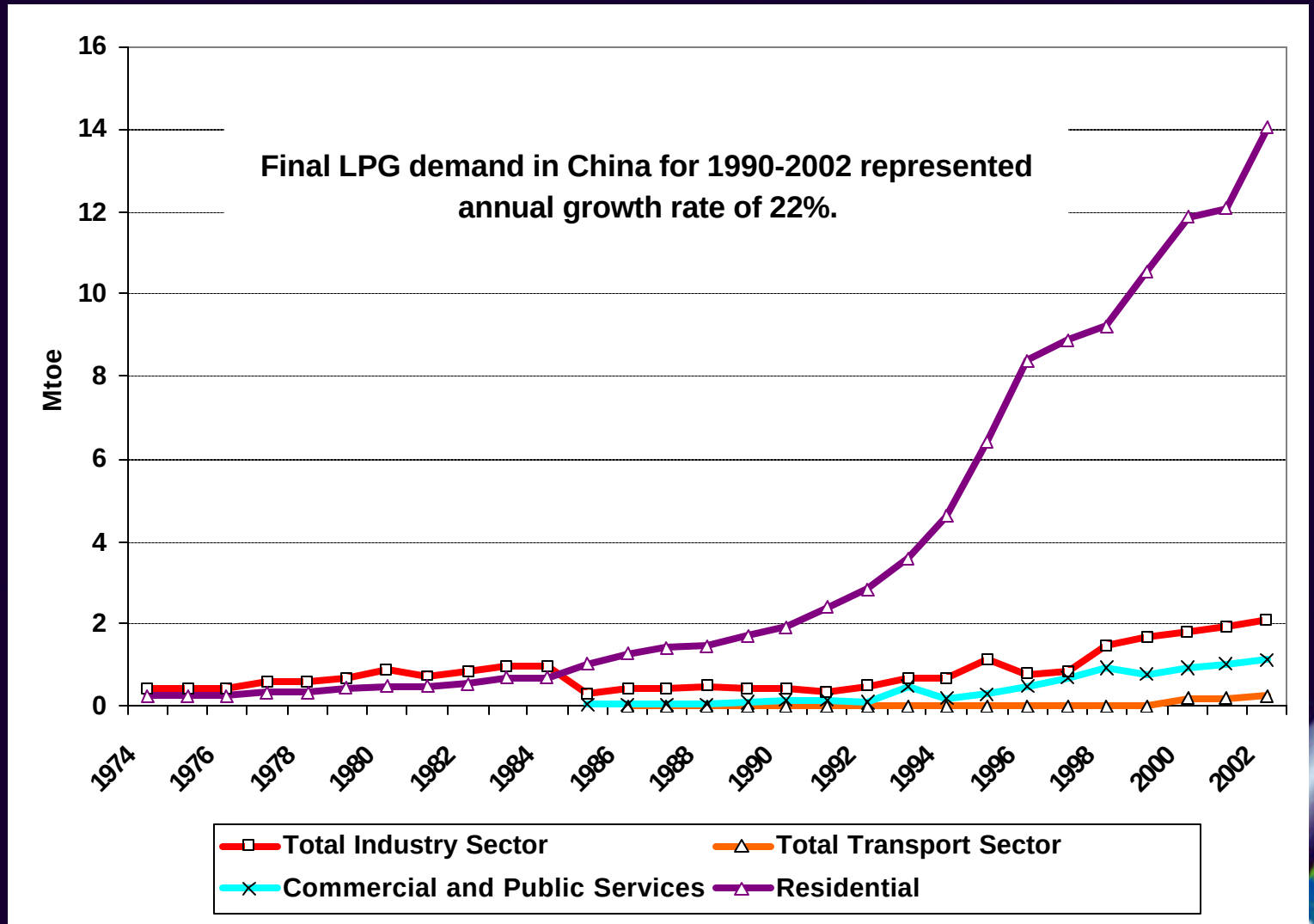
Other Notable Developments

- Equity participation of buyers in upstream
  - CNOOC in Tangguh Project
  - KOGAS in Oman Project
  - TEPCO and Tokyo Gas in Darwin Project
- Emergence and increase of short-term and spot deals
- Technology seems as though entering the mature stage
- Recently passed US energy bill to give the federal government authority to construct LNG terminals

Nevertheless …

- Economic barriers
  - Demand security ? affordability in many developing economies – per capita income
    - Gas has to compete against coal
      - China's plan for reform for electricity price – indexation to coal price
    - High distribution cost – China's city gas demand
- Financial barriers
  - High, initial capital cost ? take-or-pay
- Regulatory/Institutional barriers
  - Siting, zoning regulations
    - BANANA (Build Absolutely Nothing Anywhere, Anytime, Near Anybody) in US
  - Environmental regulations

China's LPG Demand for Residential Sector (1974-2002)



Source: APERC Analysis (2005) based on data from IEA (2004), "Energy Balances of Non-OECD Countries"

List of APERC's Publications on Natural Gas

- Natural Gas Infrastructure Development in Northeast Asia *(2000)*
- Natural Gas Infrastructure Development in Northeast Asia *(2000)*
- Natural Gas Infrastructure Development in Southeast Asia *(2000)*
- APEC Energy Pricing Practices Natural Gas End-use Prices *(2001)*
- Gas Storage in the APEC Region *(2002)*
- Natural Gas Market Reform in the APEC Region *(2003)*

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