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Energy Security: Implications for U.S.-China-Middle East Relations

Energy and Natural Gas in Northeast Asia
Options for the Future

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Economic development, in general, is correlated with increased urbanization and electrification, and growth in the use of private automobiles. The Asian experience should be no different, and absent significant growth in renewable energy supplies and/or new energy technologies, consumption of crude oil and natural gas should rise substantially as the 21st century progresses.

The emergence of China has generated much concern over the future of energy commodity movements in Asia. Japan and South Korea, both energy importers, must now compete on a global stage with China's growing demand for imported energy. This creates the opportunity for either conflict or cooperation, both regionally and on a larger global scale. The world, in general, has a strong interest in promoting cooperative behavior among the Asian neighbors, as peaceful development will inevitably create new opportunities in emerging markets. But, cooperation with regard to energy supply will only occur if supply lines can be peacefully maintained and sources of supply are diverse and secure.

The prospect for energy security is largely dependent on future demand in Northeast Asia, as well as, of course, upstream developments aimed at bringing supply to the region. When forecasting demand we must be conscious of structural changes that occur as an economy develops. Following Medlock and Soligo (2001)[1], we estimate the demand for energy by end-use sector of a sample of 30 countries from various levels of economic development, and use the results to forecast energy use by sector for select countries. Recognizing the influence of structural change during the course of economic development, the methodology allows for both the income elasticity of energy demand and energy intensity to decline as income rises. The equation to be estimated is

$$e_{i,j,t} = \alpha_{i,j} + \beta_{1,i} y_{i,j,t} + \beta_{2,i} y_{i,j,t}^2 + \beta_{3,i} p_{i,j,t} + (1-\gamma) e_{i,j,t-1} \qquad (1)$$

where y denotes per capita GDP (PPP 2000 international dollars), e denotes commercial energy consumption (ktoe), and p denotes price in sector i, country j, time period t.

[1] See Medlock, Kenneth and Ronald Soligo, "Economic Development and End-Use Energy Demand", *Energy Journal*, Volume 22, Number 2 (2001).

End-use sectors are broadly defined as industrial, transportation, and all other uses.[2] The data span the time period 1980 to 2002. Energy demand data come from the International Energy Agency (IEA) and the Asia Pacific Energy Research Centre (APERC). GDP and population data are obtained from the World Bank Development Indicators, and price data are collected from the IEA and national statistical agencies. The parameter estimates for each sector along with standard errors are given in Table 1. Individual country intercepts along with other information is available upon request.

Table 1 – Parameter Estimates[3]

	End-Use Sector		
	Industrial	**Transport**	**Other**
β_1	**0.5549**	**0.4442**	**0.1818**
std err	*0.1516*	*0.0941*	*0.0569*
β_2	**-0.0198**	**-0.0005**	**-0.0055**
std err	*0.0076*	*0.0048*	*0.0041*
β_3	**-0.0643**	**-0.0994**	**-0.0452**
std err	*0.0132*	*0.0104*	*0.0199*
$1-\gamma$	**0.6777**	**0.5710**	**0.8770**
std err	*0.0461*	*0.0367*	*0.0569*
R^2	*0.9880*	*0.9913*	*0.9967*

The parameter estimates in Table 1 indicate that for an "average" country in the sample energy demand per capita will evolve as given in Figure 1. As found in Medlock and Soligo (2001), we see that Industrial energy consumption rises fastest initially, but is eventually overtaken by demand in the other sector. Transportation energy use tends to increase the slowest, but accounts for the largest proportion of energy use in the latter stages of development. Of course, individual countries will vary about these "average" curves, but all will exhibit similar patterns.

Figure 1 – Energy Demand in a hypothetical "average" country

[2] Ideally we would like to disaggregate other into its various components but the IEA notes that due to difficulties in data reporting 'Other' is more accurate than its components.

[3] Hypothesis testing indicates that the fixed effect specification is appropriate. Moreover, instrumental variables are appropriate for the dynamic panel specification. We chose as instruments the current and lagged values of the regressors plus current and lagged values of population.

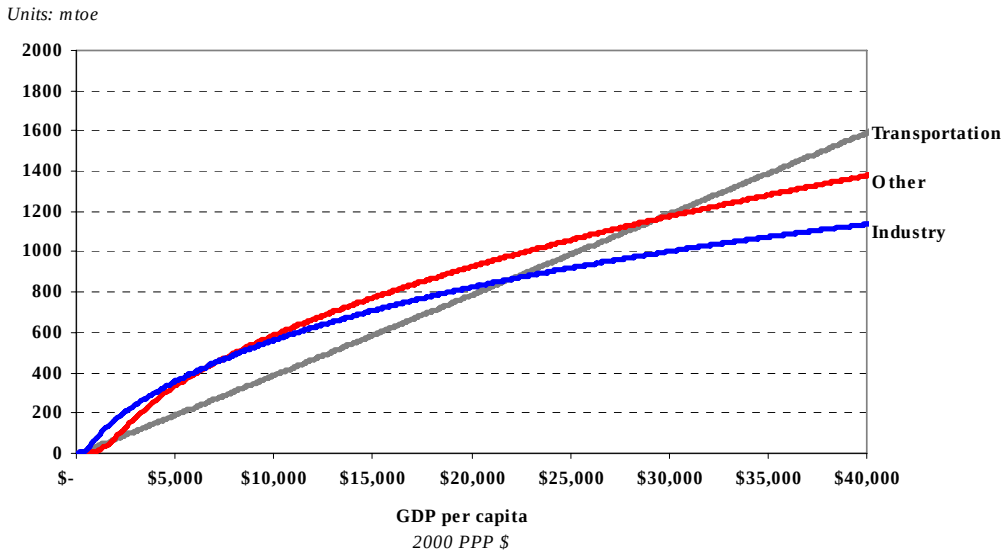
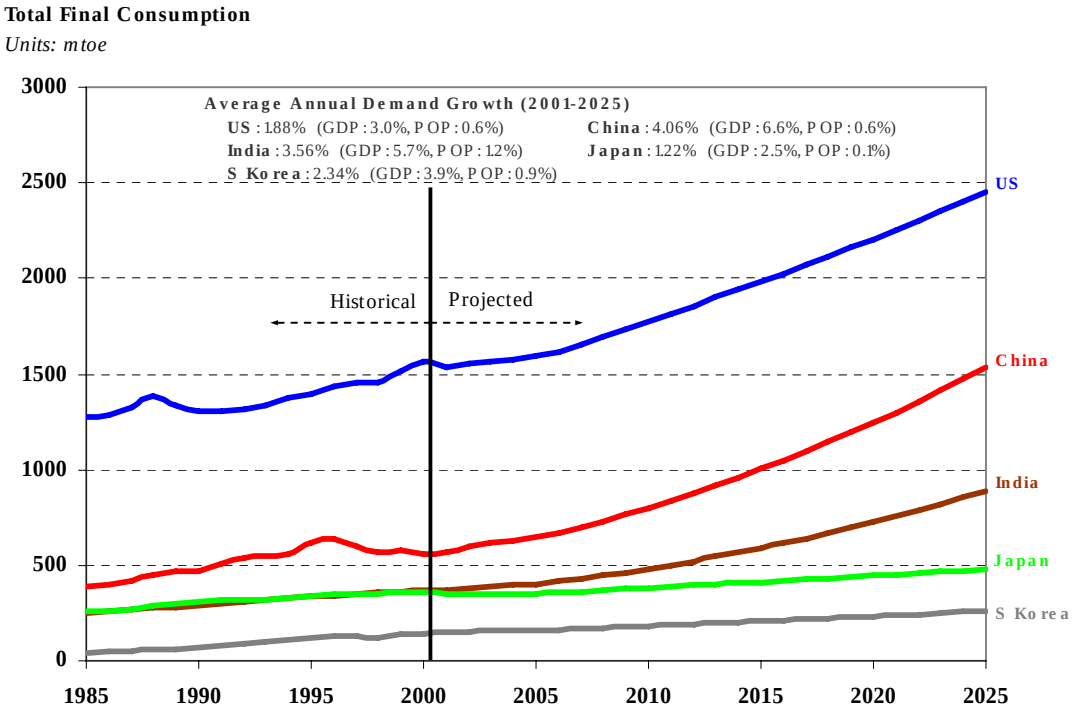


Figure 2 – Energy Demand: Historical and Projected for Select Nations



Sources: IEA, Author's own projections

The parameter estimates for equation (1) are then used to generate forecasts of energy demand by end-use sector for a select sample of countries – China, Japan, Korea, India,

and the United States–as illustrated in Figure 2. Population projections, which are needed to convert the forecasts from 'per capita', are taken from the World Bank.

By the year 2020, energy consumption in the largest developing Asian countries (China and India) is projected to rival that of North America and Europe. Much of this increase in demand will come in the transportation, residential and commercial sectors. This shift to "household" consumption is stereotypical of the development process, and is driven by increased consumer wealth. Detailed tables for energy by end-use are found in the appendix. Such growth will lead to increased demand for both crude oil and natural gas. Transportation requirements will drive growth in the demand for crude oil and petroleum products, while electric generation requirements will foster growth in natural gas demand. As indicated in Table 2, crude oil requirements are projected to increase dramatically in China, growing to 12.7 million barrels per day by 2020 in the median growth case. Detailed tables for oil demand by end-use are found in the appendix.

Chinese demand for natural gas is also projected to grow the fastest of the countries indicated. As seen in Table 3, in the median growth case, natural gas requirements are projected to increase dramatically to 170 billion cubic meters by 2020. Detailed tables for natural gas consumption by end-use are found in the appendix.

It should be noted that the share of natural gas in total primary energy (TPE) in China, even in the high growth case, is still less than 6.0% by 2020. Should environmental or other factors push China to increase consumption at an even greater rate, demand will greatly exceed domestic supply options, making LNG and/or pipeline imports a necessity. However, in effort to avoid becoming highly susceptible to political instability in oil and gas exporting, China is likely to pursue policies that will support a reduction in the country's energy intensity (defined as energy use per unit of economic output). Economic liberalization has and will continue to contribute to reductions in energy intensity by encouraging higher efficiency in production.

Table 2 – Crude Oil Demand: Historical and Projected for Select Nations

Median Growth Case

Units: bbl/day	**Total Primary Crude Oil Requirement**			
	2000	**2010**	**2015**	**2020**
China	4.44	7.05	9.51	12.74
share of TPER	*22.8%*	*26.1%*	*28.2%*	*30.5%*
India	2.29	3.28	4.28	5.55
share of TPER	*24.5%*	*26.9%*	*28.6%*	*30.3%*
Japan	5.21	5.63	6.19	6.76
share of TPER	*57.1%*	*58.3%*	*59.2%*	*60.0%*
South Korea	2.33	2.89	3.22	3.57
share of TPER	*64.3%*	*63.1%*	*61.9%*	*60.9%*
United States	17.82	21.21	24.21	27.46
share of TPER	*44.9%*	*47.2%*	*48.2%*	*49.2%*

Sources: IEA, Author's own projections

Table 3 – Natural Gas Demand: Historical and Projected for Select Nations

Median Growth Case

Units: bcm	**Total Primary Natural Gas Requirement**			
	2000	**2010**	**2015**	**2020**
China	36.991	58.637	99.926	169.910
share of TPER	*2.7%*	*3.6%*	*5.0%*	*6.8%*
India	24.985	37.120	52.555	75.730
share of TPER	*4.5%*	*5.1%*	*5.9%*	*6.9%*
Japan	79.421	82.486	87.897	93.019
share of TPER	*14.6%*	*14.4%*	*14.1%*	*13.9%*
South Korea	21.828	31.438	40.964	53.007
share of TPER	*10.1%*	*11.5%*	*13.2%*	*15.2%*
United States	652.911	695.463	754.219	813.400
share of TPER	*27.7%*	*26.0%*	*25.2%*	*24.5%*

Sources: IEA, Author's own projections

Natural Gas in Northeast Asia

Power generation requirements are likely to lead to an increase in the demand for natural gas as capital and technological factors make it a favorable option for intermediate and peak load requirements. While crude oil and petroleum products can also meet these same needs, diversification of supply considerations should generally favor natural gas

over oil in the power generation sector.[4] Environmental considerations could also accelerate growth in the demand for natural gas. Widely cited reports indicate that in China the emissions of SO_X and NO_X, as well as other pollutants associated with the burning of coal and other fossil fuels, are creating health problems that a transition to natural gas could alleviate. Development of additional hydroelectric or nuclear facilities is another option, but insufficient capital funding, along with other issues (such as waste disposal in the case of nuclear or land management in the case of hydro), presents a real obstacle.

China has targeted natural gas use to expand considerably in the coming years. This can be accomplished through increased domestic production, the construction of new liquefied natural gas (LNG) regasification facilities to bring natural gas from Russia, Australia, Southeast Asia, and the Middle East, and/or pipeline projects to bring gas from Eastern Siberia and possibly Kazakhstan. Each of these means presents its own host of issues. To begin, a large majority of China's population and economic activity occurs along the eastern coast, but the majority of its domestic resources lie inland. Thus, development of these reserves requires considerable investment in transportation infrastructure. This makes LNG an attractive option for areas in the Southeast, such as Guangdong Province. However, increased LNG imports means increased competition for LNG among Asian countries, and growth in India portends to exacerbate this. This opens the door for the development of regional alliances between importing and exporting countries, which could shape the future of political relationships in all of Asia well into the 21st century.

Development of natural gas resources in the Sakhalin area in Russia will play an important role in satisfying growth in natural gas demand in China, Japan and South Korea, either by directly or by displacement. Russian supplies could further influence natural gas flows in Northeast Asia as the development of fields in Eastern Siberia for

[4] In general, as crude oil demand grows to sate transportation needs, any growth in oil use for power generation will shift a nation's energy supply portfolio toward oil. Countries in Asia will likely follow Japan's lead in seeking diversification of energy supplies, which will push them to sources other than oil. Japanese policy following the oil shocks of the 1970's guided diversification in supply and saw substantial increases in nuclear and natural gas power generation.

export, political barriers notwithstanding, is also an attractive option. The massive reserves coupled with lack of local market mean most of the gas produced could be shipped south via pipeline to China or even east to Nahodka for export as LNG. However, a pipeline project creates potential energy security issues for China in that a large portion of its natural gas supply portfolio would be linked to a single source. From the Russian perspective, however, being linked to a single consumer may not be advantageous either. The other alternative – ship the gas east to Nahodka, where it could be liquefied for export as LNG to a potential variety of consumers – would most likely be favored by both Japan and South Korea, as it provides an alternative source of supply to each of those markets.

More generally, natural gas is increasingly becoming a global commodity. It is moved as LNG from locations in the Middle East to Japan, South Korea, and the United States. Natural gas was once thought of as a nuisance by oil developers, and much of it was either re-injected or flared. However, environmental factors which have spurred demand and reductions in the cost of long distance transportation have made it attractive for commercialization. Russia plays a pivotal role in the growth and development of natural gas as a primary fuel source in China, South Korea and Japan. Natural gas in Eastern Siberia and the Sakhalin area for transport either via pipeline or LNG could serve each of these markets. Russia also potentially serves another important role in a global natural gas market. Since Russia could potentially export natural gas into both the Atlantic and Pacific basins, it serves to link markets in the West to those in the Far East. This could damage the potential for Middle Eastern LNG suppliers to earn rents (via a premium) in markets in Japan, South Korea, and China.[5] Of course, the caveat is that any collusion on the part of major producers in Russia and the Middle East (such as the formation of a "gas-OPEC") could support the price discrimination to Far Eastern markets.

The Baker Institute World Gas Trade Model (BIWGTM)

[5] See Jaffe, Amy and Ron Soligo, "The Future of Saudi Price Discrimination: The Effect of Russian Production", James A. Baker III Institute Working Paper.

The BIWGTM is an ambitious effort by scholars at Rice University to model the future development of natural gas flows in a global market.[6] Until recently, natural gas markets around the world have been largely isolated from each other. Limited availability of regasification, shipping, and liquefaction capacity, as well as prohibitive shipping costs, have inhibited the exploitation of remote gas deposits and the flow of liquefied natural gas (LNG) from one region of the globe to another. In the last few years, however, many of the costs associated with the movement of LNG to distant markets have fallen just as the global demand for natural gas, particularly in the power generation sector, has expanded considerably. Both of these developments have encouraged further growth in LNG trade. The resulting trade between regions will connect previously isolated markets, and transmit market disturbances in one region to other regions by altering the flow of natural gas via LNG as well as pipeline.

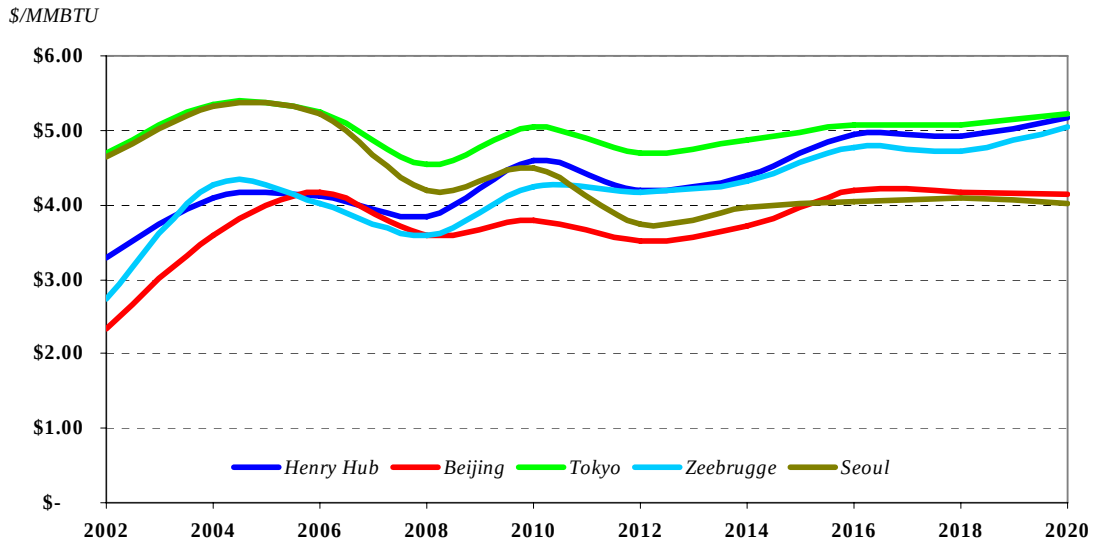
The Rice World Gas Trade Model (RWGTM) examines these developments within a framework that is based on geological data and economic theory. The resource data underlying the model is based on the work of the United States Geological Survey (USGS). That supply data is combined with economic models of the demand for natural gas, which include important determinants of natural gas use such as the level of economic development, the price of natural gas, the price of competing fuels, and population growth. The costs of constructing new pipelines and LNG facilities have also been estimated using available data on previous and potential projects available from the US Energy Information Administration (EIA). The model seeks an equilibrium in which the sources of supply, the demand sinks, and the transportation links connecting them, are developed over time to minimize the discounted present value of total costs, while simultaneously accounting for the impact of new developments on expected future prices.

The RWGTM indicates that the future movement of natural gas in Northeast Asia will change substantially. Absent any non-economic barriers to development, rapid demand growth in China will be sated by all three options indicated above: domestic production,

[6] For more detail on the model, see Hartley, Peter and Kenneth Medlock, "A Global Market for Natural Gas? Prospects to 2040", James A. Baker III Institute Working Paper.

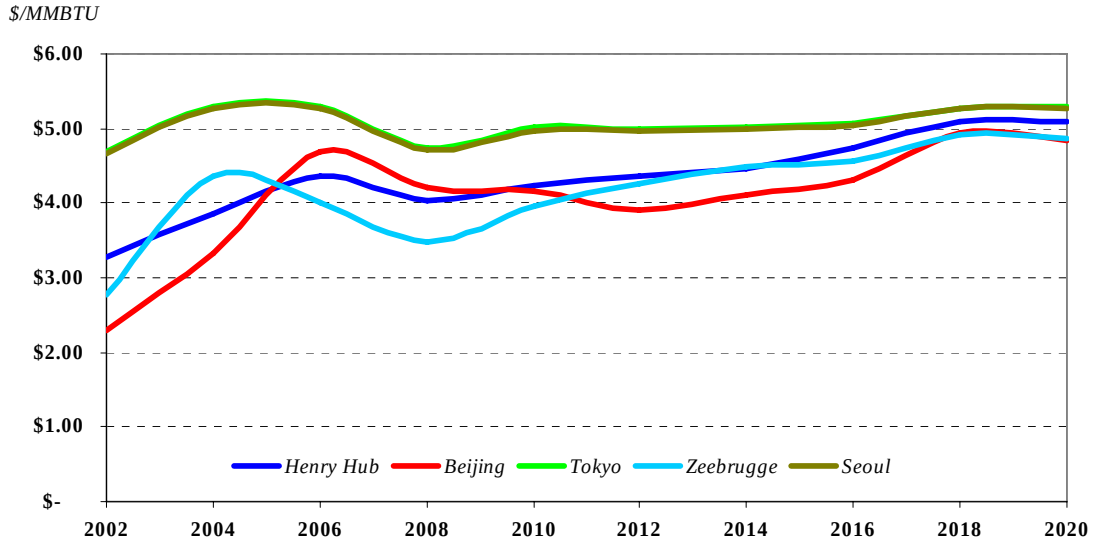
pipelines from Russia, and LNG. While demand growth in Japan and Korea is not as rapid as in China, the future of supply does change. For example, the model predicts the construction of a pipeline from Sakhalin to Japan. However, LNG remains a large proportion of total requirement as the cost of constructing a national grid is prohibitive. In addition, with regard to South Korea, the model favors bringing Russian gas via pipeline into the Korean peninsula over LNG.

Figure 3 – Select Long-term Natural Gas Prices: No Barriers



Source: Peter Hartley and Kenneth Medlock (2005) "The Baker Institute World Gas Trade Model"

Figure 4 – Select Long-term Natural Gas Prices: No Northeast Asia Pipes



Source: Peter Hartley and Kenneth Medlock (2005) "Political and Economic Influences on the Future World Market for Natural Gas"

Of course, each of these infrastructure developments occurs only in an unconstrained solution, and some are less likely to occur than others given political considerations. In particular, any pipeline route that brings gas through North Korea is an option that may not be likely to materialize in the near future. To examine the implications of such political barriers we can impose constraints in the model to prevent certain infrastructure developments.[7] In Figures 3 and 4 we can see the influence on price of not allowing any pipeline infrastructure to be developed from Russia to China or South Korea. Of note is the impact on the price of natural gas in both markets, as each is forced to rely more heavily on imported LNG. In fact, in the case where pipeline infrastructure in Northeast Asia is allowed, the Korean market moves entirely away from LNG. In addition, China receives almost 40% of its imported natural gas supplies via pipeline from Russia by 2020. Moreover, the long term impact is to increase price everywhere as competition for LNG supplies increases (although the effect is greatest in the Northeast Asia region). Price increases on average during the decade 2010-2020 by about $0.50 per million BTU

[7] For greater detail regarding the case discussed herein, the reader is encouraged to see the James A. Baker III Institute working paper by Hartley and Medlock entitled "Political and Economic Influences on the Future World Market for Natural Gas" (2005). The paper is available online at www.rice.edu/energy.

(mmbtu) in China, $0.15/mmbtu in Japan, and $1.15/mmbtu in South Korea. The increase is only $0.05/mmbtu in the US. Interestingly, pipeline flows from Sakhalin to Japan increase when no pipes are allowed in Northeast Asia (28% with pipes versus 43% without) as the absence of a pipeline option from Nahodka to South Korea increases the volumes available for export to Japan.[8] Nevertheless, the absence of natural gas flows from East Siberia serve to raise the price of gas in Japan as well.

A Comment on Cartelization in Natural Gas

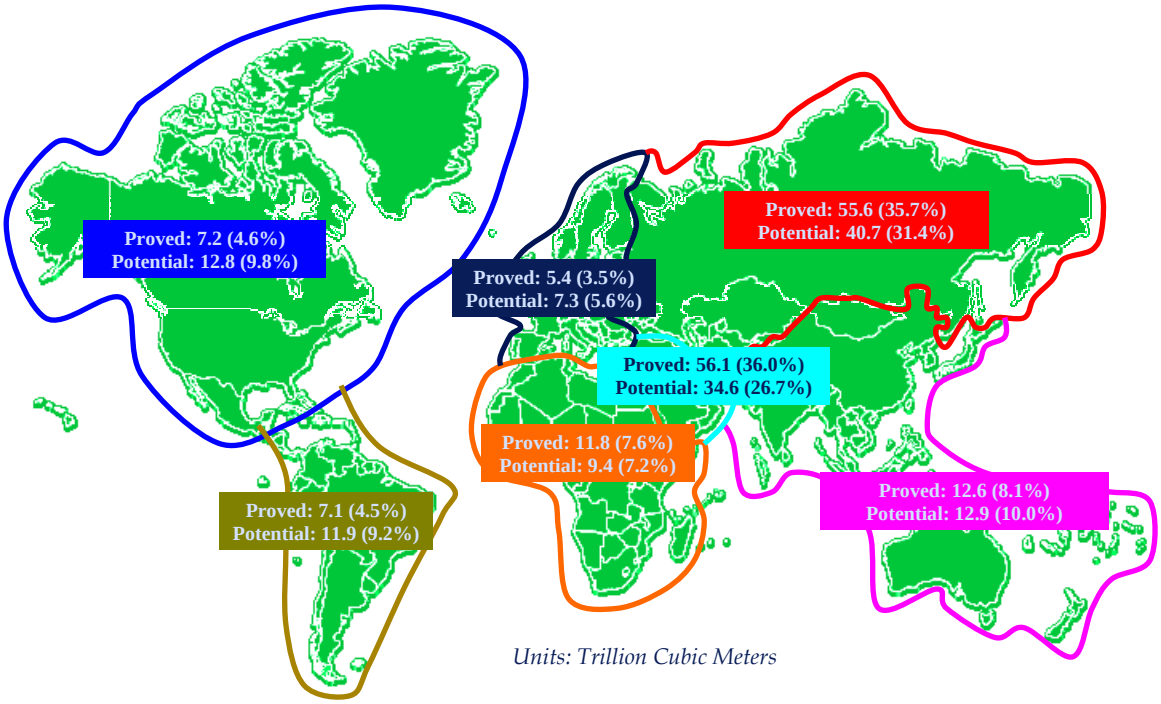
One area of attention is the potential formation of a gas cartel similar to OPEC. Already, the Gas Exporting Countries Forum (GECF) has held meetings to discuss enhanced coordination among gas producers.[9] Although the GECF ministers announced that they did not intend to manage production or set quotas, it has been reported that certain individual members of the group have debated the merits of exercising some form of market influence or control.[10] The future influence that this group may have on developing global natural gas markets is uncertain.

Figure 5 – Proved and Potential Natural Gas Resources by Region

[8] Note we can also disallow the pipeline option to Japan. This pushes all Sakhalin natural gas to export as LNG, and serves to raise price in Japan.

[9] By its third session in Doha, Qatar, GECF included 14 members: Algeria, Brunei, Egypt, Indonesia, Iran, Libya, Malaysia, Nigeria, Oman, Qatar, Russia, Trinidad and Tobago, the United Arab Emirates and Venezuela.

[10] See Jaffe, Amy and Ron Soligo (2005), "Market Structure in the New Gas Economy: Is Cartelization Possible?", James A. Baker III Institute Working Paper.



Sources: Oil and Gas Journal and United States Geologic Survey

In order for a producer or group of producers to exert monopoly power at least two very important conditions must be met. One, supplies must be concentrated in particular locales rather than evenly distributed across regions. Two, the income elasticity of demand must be very low. Over the long term, the first of these conditions is certainly true in the case of natural gas. As seen in Figure 5, a large majority of both proved and potential natural gas resource is concentrated in the countries of the Middle East and Russia. On this basis alone, if Middle Eastern producers were to collude to gain monopoly power, such efforts could be successful if the development Russian supplies were somehow prevented. In fact, a Middle Eastern premium, similar to that observed in crude oil markets, could be earned if Russian gas fails to find its way to Northeast Asia. If Russia and countries of the Middle East were to collude, then there is likely little to prevent, on the supply-side, successful cartelization. In the short term, however, it can be argued that there sufficient commercial sources of supply to prevent any successful collusion on the part of a handful of producers.

The second condition–the income elasticity of demand must be low–does not necessarily hold. Most of the growth in natural gas demand has come from the power generation sector. Improvements in the thermal efficiency of natural gas fired power plants (combined-cycle technology, for example) have enabled gas to compete for base load generation requirements. This, along with the environmental factors, has contributed to rapid growth in the construction of natural gas generation capacity. Nowhere has this been more evident than in the United States. However, rising natural gas prices have rendered much of the new capacity uneconomic, and much of it has been relegated to satisfying intermediate and peaking requirements as capacity utilization on coal and nuclear plants has increased. Such price effects are indicative of the power generation sector in general. If plants are dispatched on a competitive basis then fuel prices will determine which plants operate at particular times of the day. In the short term, therefore, high natural gas prices will favor other sources of generation.

Longer term, if prices are expected to remain high, other types of capacity become favorable. One such option is integrated gasification combined cycle (IGCC), which utilizes coal and reaps the same environmental benefits of natural gas. IGCC is a strong potential competitor for natural gas long term in some of the world's largest current and projected energy consumers–the United States, India, and China. Any collusive behavior on the part of major natural gas exporters could trigger a switch to alternative sources of supply for electric power generation, thereby diminishing the extent to which producers can earn monopoly rents. While such arguments can be made of the oil market also, there is an important difference. Individual consumers dictate the extent to which countries import oil for transportation based on their own preferences for motor vehicle type. Moreover, most of the existing infrastructure for private transportation is based on the distribution of crude oil products. Switching to an alternative source of fuel for private transport would be an extremely capital intensive undertaking requiring the coordination of many individual consumers and distributors. Alternatively, electricity can be generated by multiple sources and the construction of large power plants can render other competing facilities obsolete. Moreover, there is no need on the part of

individual consumers to coordinate with such decisions as the consumption of electricity is not dependent upon the types of installed generation capacity. For these reasons, fuel switching has been and will likely continue to be much more prevalent in the power generation sector than in the transportation sector.

While there is little on the supply side to prevent successful cartelization of a global natural gas market, there does seem to be is a potential barrier on the demand side. How these competing factors are balanced against domestic policies in consuming and producing countries remains to be seen. If policy in consuming regions mandates natural gas use, either directly or indirectly through emissions restrictions, then the demand side barriers tend to diminish. If major producing countries cannot agree on a cooperative strategy, then supply-side barriers tend to be raised. In any case, with regard to promoting energy security, it is important that consuming countries promote diversity of supply. Longer term, the development of alternative technologies is crucial, as natural gas, like any depletable resource, is a "transition" fuel.

Appendix

Energy Demand Forecasts to 2020

China

Consuming Sector	Historical *(a)* 2000	Projected 2010			Projected 2015			Projected 2020		
		4.6%	6.6%	8.6%	4.6%	6.6%	8.6%	4.6%	6.6%	8.6%
Other *(d)*	387.4	482.1	504.2	526.4	558.0	612.3	669.2	645.9	747.1	857.2
Transportation	74.1	119.2	135.7	154.0	150.8	189.1	236.0	189.1	261.0	358.2
Industrial	307.5	398.9	429.5	461.1	466.0	530.2	598.5	536.4	641.8	756.6
Total Final Consumption	769.0	1000.1	1069.3	1141.5	1174.8	1331.5	1503.7	1371.4	1649.9	1972.1
Total Primary Consumption *(b)*	973.5	1266.0	1353.6	1445.0	1487.1	1685.5	1903.4	1735.9	2088.4	2496.3
Real GDP per capita	$ 3,821	$ 5,993	$ 6,979	$ 8,105	$ 7,291	$ 9,340	$ 11,909	$ 8,871	$ 12,499	$ 17,498

Notes:
(a) Units are in mtoe
(b) Historically, Transformation losses are around 21%. Thus, to obtain Primary, we assume this value.
(c) Population is assumed to grow at a rate of 0.6% per annum. (World Bank Development Indicators, 2003)
(d) Other includes Residential, Commercial, Agriculture, and Non-Energy Uses.

Japan

Consuming Sector	Historical *(a)* 2000	Projected 2010			Projected 2015			Projected 2020		
		1.6%	2.6%	3.6%	1.6%	2.6%	3.6%	1.6%	2.6%	3.6%
Other *(d)*	112.3	116.7	118.8	121.0	121.4	126.3	131.1	125.8	133.8	142.0
Transportation	86.9	94.1	100.6	107.4	102.5	115.1	129.2	110.7	130.7	154.0
Industrial	160.7	157.8	162.1	166.4	164.0	172.0	180.2	168.5	180.4	192.4
Total Final Consumption	360.0	368.5	381.5	394.8	387.9	413.4	440.4	405.0	444.9	488.4
Total Primary Consumption *(b)*	455.7	466.5	482.9	499.8	491.1	523.3	557.5	512.7	563.1	618.2
Real GDP per capita	$ 24,675	$ 27,597	$ 29,848	$ 32,259	$ 29,730	$ 33,771	$ 38,314	$ 32,027	$ 38,209	$ 45,505

Notes:

(a) Units are in mtoe

(b) Historically, Transformation losses are around 21%. Thus, to obtain Primary, we assume this value.

(c) Population is assumed to grow at a rate of 0.1% per annum. (World Bank Development Indicators, 2003)

(d) Other includes Residential, Commercial, Agriculture, and Non-Energy Uses.

South Korea

Consuming Sector	Historical *(a)* 2000	Projected 2010			Projected 2015			Projected 2020		
		2.4%	3.9%	5.4%	2.4%	3.9%	5.4%	2.4%	3.9%	5.4%
Other *(d)*	39.9	47.6	49.0	50.4	51.4	54.6	57.9	55.1	60.6	66.3
Transportation	29.4	37.2	41.1	45.3	42.2	50.1	59.5	47.4	60.7	77.4
Industrial	73.9	87.3	91.2	95.1	93.6	101.1	108.7	99.1	110.4	122.1
Total Final Consumption	143.2	172.1	181.3	190.8	187.2	205.8	226.0	201.6	231.7	265.8
Total Primary Consumption *(b)*	181.2	217.9	229.4	241.5	237.0	260.6	286.1	255.2	293.3	336.5
Real GDP per capita	$ 15,876	$ 20,275	$ 22,787	$ 25,566	$ 22,385	$ 27,063	$ 32,630	$ 24,715	$ 32,143	$ 41,645

Notes:

(a) Units are in mtoe

(b) Historically, Transformation losses are around 21%. Thus, to obtain Primary, we assume this value.

(c) Population is assumed to grow at a rate of 0.4% per annum. (World Bank Development Indicators, 2003)

(d) Other includes Residential, Commercial, Agriculture, and Non-Energy Uses.

India

Consuming Sector	Historical *(a)* 2000	Projected 2010			Projected 2015			Projected 2020		
		3.6%	5.1%	6.6%	3.6%	5.1%	6.6%	3.6%	5.1%	6.6%
Other *(d)*	235.7	287.3	298.0	308.8	332.0	358.3	385.8	384.9	434.3	487.6
Transportation	33.5	47.7	52.6	57.9	59.1	70.2	83.2	72.7	92.9	118.3
Industrial	99.6	123.5	131.5	139.7	145.4	162.4	180.5	169.2	197.8	229.2
Total Final Consumption	368.8	458.5	482.1	506.4	536.5	590.9	649.5	626.9	725.0	835.1
Total Primary Consumption *(b)*	466.8	580.4	610.2	641.1	679.2	748.0	822.1	793.5	917.7	1057.1
Real GDP per capita	$ 2,479	$ 3,344	$ 3,754	$ 4,208	$ 3,877	$ 4,679	$ 5,631	$ 4,494	$ 5,830	$ 7,536

Notes:

(a) Units are in mtoe

(b) Historically, Transformation losses are around 21%. Thus, to obtain Primary, we assume this value.

(c) Population is assumed to grow at a rate of 1.2% per annum. (World Bank Development Indicators, 2003)

(d) Other includes Residential, Commercial, Agriculture, and Non-Energy Uses.

United States

Consuming Sector	Historical *(a)* 2000	Projected 2010			Projected 2015			Projected 2020		
		2.0%	3.0%	4.0%	2.0%	3.0%	4.0%	2.0%	3.0%	4.0%
Other *(d)*	529.7	560.5	570.4	580.3	593.2	615.5	638.0	625.9	663.7	702.3
Transportation	610.1	713.6	762.6	814.5	793.4	891.0	999.5	874.1	1031.6	1215.5
Industrial	426.8	430.6	441.5	452.2	457.1	477.7	498.3	479.2	510.1	541.1
Total Final Consumption	1566.5	1704.7	1774.5	1847.0	1843.7	1984.2	2135.7	1979.2	2205.4	2458.9
Total Primary Consumption *(b)*	1983.0	2157.8	2246.2	2338.0	2333.8	2511.6	2703.5	2505.3	2791.7	3112.6
Real GDP per capita	$ 33,293	$ 37,693	$ 40,771	$ 44,068	$ 40,406	$ 45,905	$ 52,086	$ 43,315	$ 51,684	$ 61,564

Notes:

(a) Units are in mtoe

(b) Historically, Transformation losses are around 21%. Thus, to obtain Primary, we assume this value.

(c) Population is assumed to grow at a rate of 0.6% per annum. (World Bank Development Indicators, 2003)

(d) Other includes Residential, Commercial, Agriculture, and Non-Energy Uses.

Crude Oil Demand Forecasts to 2020

China

	Historical	Projected			Projected			Projected		
	2000	**2010**			**2015**			**2020**		
		4.6%	**6.6%**	**8.6%**	**4.6%**	**6.6%**	**8.6%**	**4.6%**	**6.6%**	**8.6%**
Other										
million tons	58.0	76.3	79.8	83.4	93.4	102.5	112.0	114.3	132.2	151.7
increase of		*18.3*	*21.8*	*25.3*	*35.4*	*44.5*	*54.0*	*56.3*	*74.2*	*93.7*
million barrels per day *(a)*	1.161	1.527	1.597	1.667	1.868	2.050	2.241	2.286	2.644	3.034
increase of		*0.4*	*0.4*	*0.5*	*0.7*	*0.9*	*1.1*	*1.1*	*1.5*	*1.9*
Transportation										
million tons	66.9	108.7	123.7	140.4	138.9	174.1	217.3	175.8	242.7	333.1
increase of		*41.7*	*56.7*	*73.5*	*71.9*	*107.2*	*150.4*	*108.8*	*175.8*	*266.1*
million barrels per day	1.339	2.173	2.474	2.809	2.778	3.482	4.346	3.516	4.854	6.661
increase of		*0.8*	*1.1*	*1.5*	*1.4*	*2.1*	*3.0*	*2.2*	*3.5*	*5.3*
Industrial										
million tons	53.7	74.7	80.4	86.3	93.4	106.3	120.0	115.2	137.9	162.6
increase of		*20.9*	*26.7*	*32.6*	*39.7*	*52.6*	*66.3*	*61.5*	*84.1*	*108.8*
million barrels per day	1.075	1.493	1.608	1.726	1.869	2.126	2.400	2.305	2.758	3.251
increase of		*0.4*	*0.5*	*0.7*	*0.8*	*1.1*	*1.3*	*1.2*	*1.7*	*2.2*
Total Final										
million tons	178.7	259.7	283.9	310.1	325.7	382.9	449.4	405.3	512.8	647.3
increase of		*81.0*	*105.2*	*131.4*	*147.0*	*204.2*	*270.6*	*226.6*	*334.1*	*468.6*
million barrels per day	3.574	5.193	5.679	6.202	6.515	7.659	8.987	8.107	10.256	12.947
increase of		*1.6*	*2.1*	*2.6*	*2.9*	*4.1*	*5.4*	*4.5*	*6.7*	*9.4*
Total Primary *(b)*										
million tons	222.0	322.6	352.7	385.2	404.7	475.7	558.2	503.5	637.0	804.1
increase of		*100.6*	*130.7*	*163.2*	*182.7*	*253.7*	*336.2*	*281.5*	*415.0*	*582.1*
million barrels per day	4.4	6.5	7.1	7.7	8.1	9.5	11.2	10.1	12.7	16.1
increase of		*2.0*	*2.6*	*3.3*	*3.7*	*5.1*	*6.7*	*5.6*	*8.3*	*11.6*

Japan

	Historical	Projected			Projected			Projected		
	2000	**2010**			**2015**			**2020**		
		1.6%	**2.6%**	**3.6%**	**1.6%**	**2.6%**	**3.6%**	**1.6%**	**2.6%**	**3.6%**
Other										
million tons	57.7	60.5	61.7	62.8	63.6	66.1	68.7	66.5	70.8	75.1
increase of		*2.8*	*3.9*	*5.1*	*5.9*	*8.4*	*11.0*	*8.8*	*13.0*	*17.4*
million barrels per day *(a)*	1.155	1.211	1.234	1.256	1.273	1.323	1.374	1.331	1.415	1.502
increase of		*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*
Transportation										
million tons	85.5	92.5	98.9	105.6	100.8	113.2	127.0	108.9	128.5	151.4
increase of		*7.0*	*13.4*	*20.1*	*15.3*	*27.7*	*41.5*	*23.4*	*43.0*	*65.9*
million barrels per day	1.709	1.850	1.977	2.112	2.016	2.264	2.539	2.177	2.570	3.027
increase of		*0.1*	*0.3*	*0.4*	*0.3*	*0.6*	*0.8*	*0.5*	*0.9*	*1.3*
Industrial										
million tons	79.3	78.0	80.1	82.3	81.3	85.3	89.3	83.7	89.7	95.6
increase of		*-1.3*	*0.9*	*3.0*	*2.0*	*6.0*	*10.0*	*4.5*	*10.4*	*16.4*
million barrels per day	1.585	1.560	1.603	1.646	1.626	1.706	1.786	1.675	1.793	1.913
increase of		*0.0*	*0.0*	*0.1*	*0.0*	*0.1*	*0.2*	*0.1*	*0.2*	*0.3*
Total Final										
million tons	222.5	231.1	240.7	250.7	245.7	264.6	285.0	259.1	288.9	322.1
increase of		*8.6*	*18.2*	*28.2*	*23.2*	*42.2*	*62.5*	*36.7*	*66.4*	*99.7*
million barrels per day	4.449	4.621	4.814	5.013	4.914	5.293	5.700	5.183	5.778	6.443
increase of		*0.2*	*0.4*	*0.6*	*0.5*	*0.8*	*1.3*	*0.7*	*1.3*	*2.0*
Total Primary *(b)*										
million tons	260.4	270.4	281.7	293.4	287.6	309.7	333.6	303.3	338.1	377.0
increase of		*10.0*	*21.3*	*33.0*	*27.2*	*49.3*	*73.2*	*42.9*	*77.8*	*116.6*
million barrels per day	5.2	5.4	5.6	5.9	5.8	6.2	6.7	6.1	6.8	7.5
increase of		*0.2*	*0.4*	*0.7*	*0.5*	*1.0*	*1.5*	*0.9*	*1.6*	*2.3*

South Korea

	Historical	Projected			Projected			Projected		
	2000	**2010**			**2015**			**2020**		
		2.4%	**3.9%**	**5.4%**	**2.4%**	**3.9%**	**5.4%**	**2.4%**	**3.9%**	**5.4%**
Other										
million tons	20.0	22.9	23.6	24.3	23.7	25.1	26.6	24.3	26.7	29.2
increase of		*2.9*	*3.5*	*4.2*	*3.6*	*5.1*	*6.6*	*4.2*	*6.7*	*9.2*
million barrels per day *(a)*	0.401	0.458	0.472	0.485	0.473	0.503	0.533	0.485	0.534	0.585
increase of		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*
Transportation										
million tons	29.2	37.0	40.8	45.0	42.0	49.9	59.1	47.2	60.4	77.0
increase of		*7.8*	*11.6*	*15.8*	*12.7*	*20.6*	*29.9*	*17.9*	*31.1*	*47.7*
million barrels per day	0.585	0.740	0.817	0.900	0.839	0.997	1.182	0.943	1.207	1.540
increase of		*0.2*	*0.2*	*0.3*	*0.3*	*0.4*	*0.6*	*0.4*	*0.6*	*1.0*
Industrial										
million tons	47.6	53.6	55.9	58.3	54.7	59.1	63.5	55.2	61.5	67.9
increase of		*5.9*	*8.3*	*10.7*	*7.1*	*11.5*	*15.9*	*7.5*	*13.9*	*20.3*
million barrels per day	0.952	1.071	1.119	1.167	1.094	1.182	1.271	1.103	1.229	1.359
increase of		*0.1*	*0.2*	*0.2*	*0.1*	*0.2*	*0.3*	*0.2*	*0.3*	*0.4*
Total Final										
million tons	96.9	113.5	120.4	127.6	120.3	134.1	149.3	126.6	148.5	174.1
increase of		*16.6*	*23.5*	*30.7*	*23.4*	*37.2*	*52.4*	*29.7*	*51.6*	*77.3*
million barrels per day	1.938	2.269	2.407	2.552	2.407	2.682	2.986	2.532	2.971	3.483
increase of		*0.3*	*0.5*	*0.6*	*0.5*	*0.7*	*1.0*	*0.6*	*1.0*	*1.5*
Total Primary *(b)*										
million tons	116.5	136.4	144.7	153.4	144.7	161.2	179.5	152.2	178.6	209.4
increase of		*19.9*	*28.2*	*36.9*	*28.2*	*44.7*	*63.0*	*35.7*	*62.1*	*92.9*
million barrels per day	2.3	2.7	2.9	3.1	2.9	3.2	3.6	3.0	3.6	4.2
increase of		*0.4*	*0.6*	*0.7*	*0.6*	*0.9*	*1.3*	*0.7*	*1.2*	*1.9*

India

	Historical	Projected			Projected			Projected		
	2000	**2010**			**2015**			**2020**		
		3.6%	**5.1%**	**6.6%**	**3.6%**	**5.1%**	**6.6%**	**3.6%**	**5.1%**	**6.6%**
Other										
million tons	30.9	40.9	42.4	44.0	51.2	55.3	59.6	64.4	72.7	81.6
increase of		*10.0*	*11.5*	*13.0*	*20.3*	*24.4*	*28.6*	*33.5*	*41.7*	*50.7*
million barrels per day *(a)*	0.619	0.818	0.849	0.879	1.025	1.106	1.191	1.289	1.454	1.632
increase of		*0.2*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*1.0*
Transportation										
million tons	32.8	46.7	51.5	56.7	57.9	68.8	81.5	71.2	91.0	115.9
increase of		*13.9*	*18.7*	*23.9*	*25.1*	*36.0*	*48.7*	*38.4*	*58.2*	*83.1*
million barrels per day	0.656	0.933	1.030	1.135	1.159	1.376	1.629	1.425	1.821	2.318
increase of		*0.3*	*0.4*	*0.5*	*0.5*	*0.7*	*1.0*	*0.8*	*1.2*	*1.7*
Industrial										
million tons	30.7	39.0	41.5	44.1	47.1	52.5	58.4	56.1	65.6	76.0
increase of		*8.3*	*10.8*	*13.4*	*16.4*	*21.9*	*27.7*	*25.5*	*34.9*	*45.3*
million barrels per day	0.613	0.780	0.830	0.882	0.941	1.051	1.168	1.122	1.312	1.520
increase of		*0.2*	*0.2*	*0.3*	*0.3*	*0.4*	*0.6*	*0.5*	*0.7*	*0.9*
Total Final										
million tons	94.4	126.6	135.4	144.8	156.2	176.6	199.4	191.8	229.3	273.5
increase of		*32.1*	*41.0*	*50.4*	*61.8*	*82.2*	*105.0*	*97.4*	*134.9*	*179.1*
million barrels per day	1.889	2.531	2.708	2.896	3.124	3.533	3.988	3.836	4.586	5.471
increase of		*0.6*	*0.8*	*1.0*	*1.2*	*1.6*	*2.1*	*1.9*	*2.7*	*3.6*
Total Primary *(b)*										
million tons	114.3	153.2	164.0	175.3	189.1	213.8	241.4	232.2	277.6	331.1
increase of		*38.9*	*49.6*	*61.0*	*74.8*	*99.5*	*127.1*	*117.9*	*163.3*	*216.8*
million barrels per day	2.3	3.1	3.3	3.5	3.8	4.3	4.8	4.6	5.6	6.6
increase of		*0.8*	*1.0*	*1.2*	*1.5*	*2.0*	*2.5*	*2.4*	*3.3*	*4.3*

United States

	Historical	Projected			Projected			Projected		
	2000	**2010**			**2015**			**2020**		
		2.0%	**3.0%**	**4.0%**	**2.0%**	**3.0%**	**4.0%**	**2.0%**	**3.0%**	**4.0%**
Other										
million tons	119.6	123.6	125.8	128.0	127.8	132.6	137.5	131.8	139.7	147.9
increase of		*4.0*	*6.2*	*8.4*	*8.3*	*13.1*	*17.9*	*12.2*	*20.1*	*28.3*
million barrels per day *(a)*	2.392	2.473	2.516	2.560	2.557	2.653	2.750	2.635	2.794	2.957
increase of		*0.1*	*0.1*	*0.2*	*0.2*	*0.3*	*0.4*	*0.2*	*0.4*	*0.6*
Transportation										
million tons	592.8	694.5	742.3	792.8	773.5	868.7	974.4	853.6	1007.4	1187.0
increase of		*101.7*	*149.4*	*199.9*	*180.7*	*275.8*	*381.6*	*260.7*	*414.5*	*594.1*
million barrels per day	11.857	13.891	14.846	15.856	15.470	17.373	19.488	17.071	20.148	23.739
increase of		*2.0*	*3.0*	*4.0*	*3.6*	*5.5*	*7.6*	*5.2*	*8.3*	*11.9*
Industrial										
million tons	104.1	101.1	103.6	106.1	103.3	107.9	112.6	104.2	111.0	117.7
increase of		*-3.0*	*-0.5*	*2.1*	*-0.8*	*3.9*	*8.5*	*0.2*	*6.9*	*13.6*
million barrels per day	2.081	2.021	2.072	2.123	2.065	2.158	2.252	2.085	2.219	2.354
increase of		*-0.1*	*0.0*	*0.0*	*0.0*	*0.1*	*0.2*	*0.0*	*0.1*	*0.3*
Total Final										
million tons	816.5	919.2	971.7	1026.9	1004.6	1109.2	1224.5	1089.6	1258.1	1452.5
increase of		*102.8*	*155.2*	*210.4*	*188.1*	*292.7*	*408.0*	*273.1*	*441.6*	*636.0*
million barrels per day	16.330	18.385	19.434	20.538	20.092	22.184	24.489	21.791	25.161	29.050
increase of		*2.1*	*3.1*	*4.2*	*3.8*	*5.9*	*8.2*	*5.5*	*8.8*	*12.7*
Total Primary *(b)*										
million tons	891.0	1003.1	1060.4	1120.6	1096.2	1210.4	1336.2	1189.0	1372.8	1585.0
increase of		*112.1*	*169.4*	*229.6*	*205.3*	*319.4*	*445.2*	*298.0*	*481.9*	*694.0*
million barrels per day	17.8	20.1	21.2	22.4	21.9	24.2	26.7	23.8	27.5	31.7
increase of		*2.2*	*3.4*	*4.6*	*4.1*	*6.4*	*8.9*	*6.0*	*9.6*	*13.9*

Natural Gas Demand Forecasts to 2020

China

		Historical	Projected			Projected			Projected		
		2000	**2010**			**2015**			**2020**		
			4.6%	**6.6%**	**8.6%**	**4.6%**	**6.6%**	**8.6%**	**4.6%**	**6.6%**	**8.6%**
Other											
	million tons	5.8	11.2	11.7	12.2	20.2	22.1	24.2	36.4	42.1	48.4
	increase of		*5.4*	*5.9*	*6.4*	*14.4*	*16.4*	*18.4*	*30.7*	*36.4*	*42.6*
	bcm *(a)*	6.84	13.27	13.88	14.49	23.96	26.29	28.73	43.26	50.03	57.41
	increase of		*6.4*	*7.0*	*7.7*	*17.1*	*19.5*	*21.9*	*36.4*	*43.2*	*50.6*
Transportation											
	million tons	0.2	0.3	0.4	0.4	0.4	0.5	0.7	0.5	0.7	1.0
	increase of		*0.1*	*0.2*	*0.2*	*0.2*	*0.3*	*0.5*	*0.3*	*0.5*	*0.8*
	bcm	0.24	0.39	0.44	0.50	0.50	0.63	0.78	0.64	0.89	1.22
	increase of		*0.2*	*0.2*	*0.3*	*0.3*	*0.4*	*0.5*	*0.4*	*0.7*	*1.0*
Industrial											
	million tons	11.8	19.9	21.4	23.0	30.2	34.3	38.7	45.2	54.0	63.7
	increase of		*8.1*	*9.6*	*11.2*	*18.4*	*22.5*	*27.0*	*33.4*	*42.2*	*51.9*
	bcm	13.97	23.57	25.38	27.25	35.81	40.74	45.99	53.60	64.12	75.60
	increase of		*9.6*	*11.4*	*13.3*	*21.8*	*26.8*	*32.0*	*39.6*	*50.1*	*61.6*
Total Final											
	million tons	17.7	31.4	33.4	35.6	50.8	57.0	63.6	82.1	96.9	113.1
	increase of		*13.6*	*15.7*	*17.9*	*33.0*	*39.3*	*45.9*	*64.4*	*79.2*	*95.3*
	bcm	21.05	37.23	39.70	42.24	60.27	67.66	75.50	97.50	115.04	134.23
	increase of		*16.2*	*18.7*	*21.2*	*39.2*	*46.6*	*54.5*	*76.4*	*94.0*	*113.2*
Total Primary *(b)*											
	million tons	26.1	46.2	49.3	52.4	74.8	84.0	93.7	121.0	142.8	166.6
	increase of		*20.1*	*23.2*	*26.3*	*48.7*	*57.9*	*67.6*	*94.9*	*116.7*	*140.5*
	bcm	31.01	54.9	58.5	62.2	88.8	99.7	111.2	143.7	169.5	197.8
	increase of		*23.8*	*27.5*	*31.2*	*57.8*	*68.7*	*80.2*	*112.6*	*138.5*	*166.8*

Japan

		Historical	Projected			Projected			Projected		
		2000	**2010**			**2015**			**2020**		
			1.6%	**2.6%**	**3.6%**	**1.6%**	**2.6%**	**3.6%**	**1.6%**	**2.6%**	**3.6%**
Other											
	million tons	12.3	12.8	13.1	13.3	13.3	13.9	14.4	13.8	14.7	15.6
	increase of		*0.5*	*0.7*	*1.0*	*1.0*	*1.5*	*2.1*	*1.5*	*2.4*	*3.3*
	bcm *(a)*	14.64	15.21	15.50	15.78	15.84	16.47	17.10	16.42	17.46	18.53
	increase of		*0.6*	*0.9*	*1.1*	*1.2*	*1.8*	*2.5*	*1.8*	*2.8*	*3.9*
Transportation											
	million tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	increase of		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
	bcm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	increase of		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Industrial											
	million tons	10.8	10.7	11.0	11.3	11.2	11.8	12.3	11.6	12.4	13.3
	increase of		*-0.1*	*0.2*	*0.5*	*0.4*	*0.9*	*1.5*	*0.8*	*1.6*	*2.4*
	bcm	12.86	12.72	13.07	13.41	13.31	13.97	14.63	13.78	14.75	15.74
	increase of		*-0.1*	*0.2*	*0.6*	*0.4*	*1.1*	*1.8*	*0.9*	*1.9*	*2.9*
Total Final											
	million tons	23.2	23.5	24.1	24.6	24.6	25.6	26.7	25.4	27.1	28.9
	increase of		*0.4*	*0.9*	*1.4*	*1.4*	*2.5*	*3.6*	*2.3*	*4.0*	*5.7*
	bcm	27.50	27.93	28.56	29.19	29.15	30.44	31.73	30.19	32.21	34.27
	increase of		*0.4*	*1.1*	*1.7*	*1.7*	*2.9*	*4.2*	*2.7*	*4.7*	*6.8*
Total Primary *(b)*											
	million tons	66.7	67.8	69.3	70.9	70.8	73.9	77.0	73.3	78.2	83.2
	increase of		*1.0*	*2.6*	*4.1*	*4.0*	*7.1*	*10.3*	*6.5*	*11.4*	*16.4*
	bcm	79.23	80.5	82.3	84.1	84.0	87.7	91.4	87.0	92.8	98.7
	increase of		*1.2*	*3.1*	*4.9*	*4.8*	*8.5*	*12.2*	*7.8*	*13.6*	*19.5*

South Korea

		Historical	Projected			Projected			Projected		
		2000	**2010**			**2015**			**2020**		
			2.4%	**3.9%**	**5.4%**	**2.4%**	**3.9%**	**5.4%**	**2.4%**	**3.9%**	**5.4%**
Other											
	million tons	8.0	10.9	11.2	11.5	13.4	14.3	15.1	16.4	18.1	19.8
	increase of		*2.9*	*3.2*	*3.5*	*5.4*	*6.3*	*7.1*	*8.5*	*10.1*	*11.8*
	bcm *(a)*	9.47	12.93	13.31	13.68	15.94	16.93	17.95	19.51	21.46	23.51
	increase of		*3.5*	*3.8*	*4.2*	*6.5*	*7.5*	*8.5*	*10.0*	*12.0*	*14.0*
Transportation											
	million tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	increase of		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
	bcm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	increase of		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Industrial											
	million tons	3.8	5.5	5.8	6.0	7.3	7.9	8.4	9.5	10.5	11.6
	increase of		*1.7*	*2.0*	*2.2*	*3.5*	*4.0*	*4.6*	*5.7*	*6.7*	*7.8*
	bcm	4.51	6.55	6.84	7.13	8.63	9.32	10.02	11.22	12.51	13.82
	increase of		*2.0*	*2.3*	*2.6*	*4.1*	*4.8*	*5.5*	*6.7*	*8.0*	*9.3*
Total Final											
	million tons	11.8	16.4	17.0	17.5	20.7	22.1	23.6	25.9	28.6	31.4
	increase of		*4.6*	*5.2*	*5.8*	*8.9*	*10.3*	*11.8*	*14.1*	*16.8*	*19.7*
	bcm	13.99	19.48	20.15	20.82	24.57	26.25	27.97	30.73	33.97	37.33
	increase of		*5.5*	*6.2*	*6.8*	*10.6*	*12.3*	*14.0*	*16.7*	*20.0*	*23.3*
Total Primary *(b)*											
	million tons	18.3	25.5	26.4	27.3	32.2	34.4	36.7	40.3	44.5	49.0
	increase of		*7.2*	*8.1*	*9.0*	*13.9*	*16.1*	*18.3*	*22.0*	*26.2*	*30.6*
	bcm	21.78	30.3	31.4	32.4	38.3	40.9	43.5	47.8	52.9	58.1
	increase of		*8.5*	*9.6*	*10.6*	*16.5*	*19.1*	*21.8*	*26.1*	*31.1*	*36.3*

India

		Historical	Projected			Projected			Projected		
		2000	**2010**			**2015**			**2020**		
			3.6%	**5.1%**	**6.6%**	**3.6%**	**5.1%**	**6.6%**	**3.6%**	**5.1%**	**6.6%**
Other											
	million tons	0.4	0.9	1.0	1.0	2.1	2.2	2.4	4.6	5.2	5.8
	increase of		*0.5*	*0.6*	*0.6*	*1.7*	*1.8*	*2.0*	*4.2*	*4.8*	*5.4*
	bcm *(a)*	0.48	1.11	1.16	1.20	2.47	2.66	2.87	5.47	6.18	6.93
	increase of		*0.6*	*0.7*	*0.7*	*2.0*	*2.2*	*2.4*	*5.0*	*5.7*	*6.5*
Transportation											
	million tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	increase of		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
	bcm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	increase of		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Industrial											
	million tons	9.3	12.7	13.5	14.3	16.3	18.3	20.3	20.8	24.3	28.2
	increase of		*3.3*	*4.2*	*5.0*	*7.0*	*8.9*	*10.9*	*11.5*	*15.0*	*18.8*
	bcm	11.09	15.06	16.03	17.03	19.40	21.67	24.08	24.71	28.88	33.46
	increase of		*4.0*	*4.9*	*5.9*	*8.3*	*10.6*	*13.0*	*13.6*	*17.8*	*22.4*
Total Final											
	million tons	9.7	13.6	14.5	15.4	18.4	20.5	22.7	25.4	29.5	34.0
	increase of		*3.9*	*4.7*	*5.6*	*8.7*	*10.8*	*13.0*	*15.7*	*19.8*	*24.3*
	bcm	11.57	16.17	17.18	18.22	21.87	24.33	26.95	30.18	35.05	40.39
	increase of		*4.6*	*5.6*	*6.7*	*10.3*	*12.8*	*15.4*	*18.6*	*23.5*	*28.8*
Total Primary *(b)*											
	million tons	21.0	29.4	31.2	33.1	39.7	44.2	48.9	54.8	63.6	73.3
	increase of		*8.4*	*10.2*	*12.1*	*18.7*	*23.2*	*27.9*	*33.8*	*42.6*	*52.3*
	bcm	24.93	34.9	37.0	39.3	47.1	52.4	58.1	65.1	75.5	87.1
	increase of		*9.9*	*12.1*	*14.4*	*22.2*	*27.5*	*33.1*	*40.1*	*50.6*	*62.1*

United States

		Historical	Projected			Projected			Projected		
		2000	**2010**			**2015**			**2020**		
			2.0%	**3.0%**	**4.0%**	**2.0%**	**3.0%**	**4.0%**	**2.0%**	**3.0%**	**4.0%**
Other											
	million tons	189.4	200.7	204.2	207.8	212.7	220.7	228.7	224.7	238.2	252.1
	increase of		*11.3*	*14.8*	*18.4*	*23.3*	*31.3*	*39.3*	*35.3*	*48.8*	*62.7*
	bcm *(a)*	224.84	238.23	242.45	246.65	252.48	261.96	271.53	266.73	282.82	299.28
	increase of		*13.4*	*17.6*	*21.8*	*27.6*	*37.1*	*46.7*	*41.9*	*58.0*	*74.4*
Transportation											
	million tons	15.2	18.4	19.7	21.0	21.2	23.8	26.7	24.2	28.6	33.7
	increase of		*3.2*	*4.5*	*5.8*	*6.0*	*8.6*	*11.5*	*9.0*	*13.4*	*18.5*
	bcm	18.02	21.85	23.35	24.94	25.18	28.28	31.72	28.76	33.94	39.99
	increase of		*3.8*	*5.3*	*6.9*	*7.2*	*10.3*	*13.7*	*10.7*	*15.9*	*22.0*
Industrial											
	million tons	155.3	155.5	159.4	163.3	163.8	171.2	178.6	170.5	181.5	192.5
	increase of		*0.2*	*4.1*	*8.0*	*8.5*	*15.9*	*23.3*	*15.2*	*26.2*	*37.2*
	bcm	184.36	184.62	189.27	193.89	194.50	203.27	212.03	202.41	215.47	228.54
	increase of		*0.3*	*4.9*	*9.5*	*10.1*	*18.9*	*27.7*	*18.1*	*31.1*	*44.2*
Total Final											
	million tons	359.9	374.6	383.3	392.1	397.7	415.7	434.1	419.4	448.3	478.3
	increase of		*14.7*	*23.5*	*32.2*	*37.9*	*55.8*	*74.2*	*59.5*	*88.5*	*118.4*
	bcm	427.22	444.70	455.06	465.48	472.16	493.51	515.29	497.90	532.23	567.82
	increase of		*17.5*	*27.8*	*38.3*	*44.9*	*66.3*	*88.1*	*70.7*	*105.0*	*140.6*
Total Primary *(b)*											
	million tons	548.7	571.1	584.4	597.8	606.4	633.8	661.8	639.5	683.6	729.3
	increase of		*22.5*	*35.8*	*49.1*	*57.7*	*85.1*	*113.1*	*90.8*	*134.9*	*180.6*
	bcm	651.35	678.0	693.8	709.7	719.9	752.4	785.6	759.1	811.5	865.7
	increase of		*26.7*	*42.5*	*58.3*	*68.5*	*101.1*	*134.3*	*107.8*	*160.1*	*214.4*