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The Changing Risks in Global Oil Supply and Demand:

Crisis or Evolving Solutions?

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Executive Summary

The future of energy is of enormous importance. The global energy market is intricate and the analysis of it is uncertain. The ability of policy planners and strategists in petroleum-consuming nations is limited at best. Most of the known world reserves exist in regions and countries that are not stable. Consumers cannot control where oil reserves exist and the geostrategic risks are not likely to change in the near future.

The dynamics of the current oil market rely on four major interdependent areas of uncertainty: geostrategic risks, macroeconomic fluctuations, nature of resources risks, and the uncertainty in current and future oil production capacity.

At this point, about all that is certain is that the global energy market is unpredictable and that recent oil prices have been high and volatile. In four years, the price per barrel of oil has increased by roughly 108%. The price of crude oil averaged $25.9/barrel in 2001 and for the first eight months of 2005, the average price crude oil increased to approximately $54.1/barrel.[i]

Rigorous, transparent, and credible analysis, however, can improve our understanding of the forces at play and provide policy makers and analysts the tools necessary to forge sound energy policy based on real-world realities and risks.

Key Geopolitical Uncertainties

The six major petroleum-producing areas (Middle East, Africa, Asia-Pacific, Europe-Eurasia, North America, and Latin America) face major production and resource uncertainties. It is clear the geostrategic risks facing these regions have tangible implications on their energy sector and on the global petroleum market. The geopolitical and military implications are hard to quantify. The risk premium of these uncertainties, however, will be affected by the following key geostrategic challenges, all of which could have direct and indirect affect on the global energy market:

- **Stability of oil exporting nations:** The stability of oil producing nations is of paramount importance to the world oil market. The strikes in Venezuela, the War in Iraq, and the ongoing disruptions of Angolan and Nigeria oil were examples of what could happened if this happened in other countries such as Saudi Arabia and Iran.

- **Terrorism in the Gulf and oil facilities securities**: While the threat from Iran's conventional military may be real, the more dangerous threat is that of extremists groups' asymmetric attacks on oil facilitates. The Gulf contains over 65% of the world's "proven" reserves. There is no attack-proof security system. It may take only one asymmetric or conventional attack on a Ghawar or tankers in the Strait of Hormuz to through the market into a spiral at least for the near future.

- **Proliferations of WMD**: The success in stopping the AQ Khan does not mean the end of a nuclear black market. It remains a real threat to the entire world, especially the Gulf, of a nuclear weapon falling in "the wrong hands" such as Al-Qaeda.

- **Embargos and sanctions:** Another OPEC oil embargo is very unlikely, however, if oil is ever used a weapon to combat US or Western foreign policy or if sanctions were imposed on Iran, for example, it will have devastating effects on the global economy.

- **Ethnic conflicts and strives:** Disagreements over the control of oil revenues by ethnic groups can destabilize countries and disrupt the flow of oil. Currently, the ongoing conflict in the Niger Delta and the War in Iraq provide two examples of how devastating such crises are.

- **Natural disasters:** Natural incidents in production, export, or refining areas can be damaging to the energy market. Hurricanes in the Gulf of Mexico have caused supply and distribution disruption in the US, and have added large premiums to the price of a barrel of oil. Hurricanes Katrina and Rita, which hit the US during August and September 2005, shut down most of the refineries in the US Gulf of Mexico and forced the US to release some of their strategic petroleum reserves.

- **Security problems and accidents:** The world can absorb the problems created by most forms of local conflict and internal security problems when there is significant surplus capacity and prices start from a relatively low base. Behavior changes drastically, however, when supply is very limited and prices are already high. Even potential threats to petroleum production, exports, and distribution can radically alter prices and market behavior. Actual attacks, or major industrial accidents, can have a much more serious impact. The loss of a major supplier, or a sustained major reduction in regional exports, potentially can have unpredictable price and supply impacts that impact on the entire global economy.

Stability in petroleum exporting regions is tenuous at best. Algeria, Iran, and Iraq all present immediate security problems, but recent experience has shown that exporting countries in Africa, the Caspian Sea, and South America are no more stable than the Gulf. There has been pipeline sabotage in Nigeria, labor strikes in Venezuela, alleged corruption in Russia, and civil unrest in Uzbekistan and other FSU states.

Experts believe that, in the near future, energy supply and transportation routes may be challenged by transnational terrorism and proliferation. It is equally possible that recent surges in the demand for oil, supply disruptions by hurricanes, the US refining capacity bottleneck, and the limited spare production capacity will continue to test the energy market in the mid to long-term.[ii] Natural disasters, such as hurricanes and tsunamis, may also prove to be troublesome to the instability of the energy markets by causing production, transportation, and refining disruptions.

Macroeconomic Fluctuations

Like all economic forecasts, predicting supply, demand, and prices of crude oil involves significant uncertainty. Predicting the oil market is notoriously difficult and constant updates and additions to the models are needed. The most recent EIA, IEA, and OPEC forecasts have not been adjusted to consider long-term oil prices in the $50 and above range, even in their high oil price case. Only the EIA analysis partially addresses high price cases for petroleum and it does not examine the influence these high prices would have on the demand, supply, and the long-term elasticity of global energy balances.

The following key factors influence the oil market, and each involves major uncertainties and unknowns:

- **Problems in import-dependent developing countries**: Countries with relatively free market economies that are highly developed are rich and flexible enough to adapt to high prices and supply problems far more flexible than poor countries, countries with serious foreign reserve and balance of payments problems, and importers with high levels of subsidies for oil and gas. By and large, the impact of high prices is not modeled in such terms.

- **The sustainable and spare capacity of oil producing countries:** There is a growing debate over spare capacity of OPEC nations, and their ability to “balance the market.” Perceptions are as important as realities. The market’s lack of confidence in the producers to meet the demand adds a risk premium to any estimates and pushes prices up.

- **The cost of sustaining and expanding petroleum production and exports, and of the necessary investments**: Most of today's estimates of the cost of future production are badly dated, and do not take into account the cost of the most advanced technology for exploration, development, and production, or the scale of the investment needed in distribution in areas like port facilities, new tankers, refineries, etc. Cost models need a major reevaluation.

- **Country capability and practice in sustaining and expanding petroleum production and exports:** There is little effort to assess country-by-country capability to use best practices, and adopt the most advanced technology and methods. Countries like Kuwait and Iran have failed to move forward in using such practices for very different reasons. Countries like Iraq face insurgency, the risk of civil war, and a long legacy of underfunding proper development.

- **The long-term elasticity of demand:** The development of alternative sources of energy, efficiency, and conservation have long-term effect on the market, but time lags, investment costs, and delivery prices are uncertain at best in the foreseeable future.

- **The Long-term elasticity of supply:** Major debates exist over the size of proven, possible, and potential resources' rates of discovery, development and production costs, fields' life, and the impact of advanced technology.

- **The refining capacity and inventory build up of the importing nations:** The lack of ability by importing states to refine crude oil and distribute it to the domestic market in a timely manner can build bottlenecks. These bottlenecks exert upward pressure on the price of crude oil and squeeze the average consumer at the gas bump.

- **The overall health of the global economy:** While it is clear that oil prices and economic growth in developed countries are negatively correlated, it works both ways. High oil prices have negative effect on economic growth in consuming states, but low economic growth in industrialized nations causes a decrease in demand for oil and lower oil prices.

- **The rise of new economic powers:** In recent years, the oil market has experienced an unexpected increase demand of oil from countries in Asia such as China and India. According to the IMF, this surge from emerging countries could account for 40% of the increase in oil demand in 2004.

- **Lack of investment:** These pressures and uncertainties add to the economic risk premium causing oil prices to rise further. Moreover, while higher oil prices may provide incentives for private and public investment in the oil industry, the lack of geopolitical stability, and ability to predict how long high oil prices will continue, prevents many from investing in these areas.

  Providing the kind of massive surges in the demand for oil projected in recent studies, requires massive investments to build new infrastructure and finance new technologies. In 2003, the IEA projected that the world oil demand would rise by 60% by 2030, and that the world energy market would need $16 trillion of cumulative investment between 2003 and 2030 or $568 billion a year. Even this estimate is based on unrealistically low estimates of investment cost and outdated assumptions about the sophisticated exploration, development, and production technology and equipment needed in modern oil fields. Yet it still requires vast transfers of capital.

It is too soon to draw any firm conclusions about the impact of high oil prices on global oil dependence, on US and other imports, and on increases in conservation and the supply of alternative fuels, but these factors indicate that high prices are not necessarily bad for the global economy and could trigger market forces that offset their short-term negative effects. The fact, however, is that no one really knows given the complex mix of elasticities involved because meaningful modeling and analysis is only beginning.

Nature of Resource Risks

Given the strategic risks faced by oil producing nations, claims about production goals and capacity and oil reserves have long been a political tool. Some producers have

inflated their "proven" reserves to project strategic importance, which has added to the uncertainty and the lack of transparency.

The fall of the Shah in 1979 and the Iran-Iraq War, for examples, led to a competition in the Gulf to announce new levels of "proven" reserves to demonstrate the strategic importance of given countries, and major increases in the claims made by Iran, Iraq, Saudi Arabia, Kuwait, and other countries.

Limited hard data are available to validate many national claims and plans. Yet, credibility in this area is of enormous importance because as we will see key modelers depend on each country's report for their demand-driven models to forecast the global supply and demand. In many cases, data are lacking, there is little validation and transparency, and current models and estimates simply assume levels of petroleum capacity that may never exist.

The global energy market faces key uncertainties in the determining the exact nature of reserves, which include:

- **True nature of reserves:** There are ongoing debates on the reliability of reserves. The USGS 2000 continues to be the benchmark estimate. However, as with any estimates, forecasting uncertain. Furthermore, analysts disagree about the definition of "known" vs. "undiscovered" vs. "proven" resources.
- **Impact of technological gain:** Some experts argue that aging oil fields have higher water cuts and that "vertical" wells cannot be used. Other energy estimates do not take into account new technological developments, which may change the estimate of "possible" & "probable" reserves.
- **Ability to substitute for current super-giant and giant fields:** Some experts have argued that new field discoveries do not support reserve estimates, and major producers such as Saudi Arabia, Iraq, Kuwait, and UAE rely on aging super-giant fields that were discovered in the 1950s and 1960s and are in decline, and that none of their kind has been found in recent years.
- **Rate of decline in fields:** The percentage of the oil reserves in the fields that have pumped out is a contentious and uncertain estimate. Analysts and investors have to rely on independent estimates and the announcements by oil companies.
- **Rate and size of new developments and discoveries:** Outside analysts have to rely on the discovering country's announcement and statement for estimate of any new discoveries. Moreover, it remains uncertain whether certain countries are "over explored" or "under-explored."
- **Inaccuracy of 3-D seismic modeling:** Some experts have argued that new technologies that use computer modeling are not enough. They provide a good estimate of possible reserves, but they do not replace old fashion drilling and physically measuring actual reserves.

In many cases, it is not clear that the Energy Information Administration (EIA), International Energy Agency (IEA), Organization of Petroleum Exporting Countries (OPEC), or United States Geological Survey (USGS) have applied sufficient rigor to a country-by-country reexamination of such estimates. (The USGS does use a different methodology because it looks at the basins on a geological potential basis, but the data available are uncertain and dated.)

Lack of Robust Modeling

Modeling urgently needs to examine supply-driven models, not just demand-driven models. Equally important, the key modelers of global energy supply and demand have not yet chosen to react to the recent rises in oil prices and examine cases that go above

$50 a barrel in detail. There have been some preliminary efforts by the IMF and the EIA in its *International Energy Outlook 2005*. Projections by OPEC, the IEA, and the latest EIA's forecasts need to be revised or expanded to examine such cases, and to examine the implications of a world with a "sustained" $60/barrel, $80/barrel, or even $100/barrel oil.

The modeling of sustained high price cases is just beginning, but previous modeling efforts do provide important warnings. If oil prices drop back to the level between $31 and $35 a barrel (in 2003 dollars), as assumed in the reference case of the *International Energy Outlook 2005*, the EIA estimates that world demand for oil will increase from 78 MMBD in 2002 to 119 barrels per day in 2025. This projected increase of world oil demand would require the global oil production to increase by 42.0 MMBD over the world's 2002 capacity levels--accounting for approximately 38% of the world's energy consumption through 2025.[iii] In addition, a 2004 EIA report estimates that the US and its major trading partners in developing Asia will account for 60% of the increase in world demand through this period.[iv]

More generally, many laymen do not understand the wide range of problems in foundations on which forecasting methodology is based. It is all too clear that the modeling the EIA, IEA, and OPEC used in the global petroleum supply and demand forecasting has been driven by estimating global demand at comparatively low oil prices.

Reports by the EIA, IEA, and OPEC could provide a better benchmark for the global energy market if they addressed certain areas of deficiencies. The key gaps and areas of uncertainty in the *International Energy Outlook 2005*, for example, include:

- **Parametric analysis:** They lack of any parametric analysis of its oil price forecast. Furthermore, models such as the IEO treat major shifts in energy cost and different levels of economic growth largely as independent assumptions and variables.

- **Economic growth rates:** They do not provide sufficient explanation as to how the rates of economic growth interact with the price of oil and how the price-elasticity of demand changes over time given an economic growth rate.

- **Countries' plans:** They do not take into account country-by-country plans in forecasting oil production capacity. If they do, there is little explanation of how such plans have changed since their last forecast and how realistic or unrealistic those plans are.

- **Indirect imports:** The reports do not make estimates of indirect imports of oil/petroleum from other regions in terms of the energy required to produce finished goods. The US, for example, indirectly imported very significant amounts of oil in the form of manufactured goods from Asian countries dependent on Middle Eastern oil imports.

- **Technological improvements:** They do not explicitly analyze technological improvements and the role technological breakthroughs in enhancing oil recovery and exploration for new oil reservoirs, development that have significant affects on future oil supply and the oil market.

- **Relation of oil prices to demand of alternatives and conservation:** No credible explanations are given of the interactions between different oil prices and the level of oil supply and demand, or changes in the supply and demand of gas, coal, nuclear power, renewables, electricity, and conservation.

- **Supply and demand elasticities:** No effort is made to determine the very different patterns of elasticity in supply and demand for gas, coal, nuclear power, renewables, electricity, and

conservation that have to emerge over time if oil prices remain so much higher than in the past, or the major uncertainties that will inevitably result from such changes.

- **Discontinuity theory**: Models and forecasts use smooth curves and largely "static" assumptions. Growth in demand and supply tends to be at constant rates or in predictable curves. Reality never produces consistent trends or allows trees to grow to the sky. There is a clear near for an assessment of what kind of sudden events or discontinuities are critical and for some form of Baseian approach to risk analysis.

As a result of these gaps, the current forecasts of EIA, IEA, and OPEC now do little more than illustrate what might happen in a world where virtually everything goes right from the importer's view, where export capacities automatically respond to need, and political and military risk have no impact.

Oil Production Uncertainties

If high-sustained demand growth actually occurs, virtually all sources indicate that it will put a growing strain on both global petroleum supply and export capacity. The BP's *Statistical Review of World Energy 2005* reported that in 2004, the average total world production was 80.26 MMBD—higher than the 2003 average by 3.206 MMBD. In 2004, OPEC produced 32.927 MMBD, which is a 7.7% increase from their 2003 production levels of 2.241 MMBD, Russia increased its production by 0.741 MMBD (+8.9%), and China by 0.089 MMBD (+2.9%).[v]

Non-OPEC supply so far has been slow to respond to the high oil prices. In fact, it increased by only 0.046 MMBD in 2004 (31.8% of which came from the FSU). According to the US DOE, the expected increase in Non-OPEC oil production for 2005 is 0.92 MMBD.[vi] In the years of 2005 and 2006, more than half of this non-OPEC increase is estimated to come from the FSU and the Atlantic Basin, including Latin America and West Africa.[vii]

The EIA forecasts the total world production capacity in 2025 for the low, medium, and high price cases as follows: 135.2 MMBD for the low price case, 122.2 MMBD for the reference case, and 115.5 MMBD for the high price case. In both the 2004 and 2005 cases, the projected increase in total world production capacity is still significant. By 2010, it could increase from 14.6 MMBD to as high as 21.6 MMBD. The "high price" case, however, is far easier to achieve in the real world than the "reference" or "low price" cases.

As is clear from these numbers, as the price oil decreases, production capacity increases. One notable exception is that Non-OPEC countries' production capacities have the opposite reaction to a change in the price of oil. OPEC countries largely drive this relationship between price and production capacity. From an economics point of view, a decrease in the price of oil decreases the willingness of suppliers to produce and sell oil. The *IEO2005*, however, shows the opposite effect for OPEC countries. One possible explanation is that OPEC countries control the price of oil with their quotas.

The shift toward high oil prices could, however, sharply reduce the growth in future demand for oil, and lead to major new investment in all forms of energy supply, conservation, and efficiency. In the interim, however, the following points production and resource risks now affect oil-producing nations in their efforts to expand their spare capacity:

- **Little "sustainable" spare capacity:** With the exception of Saudi Arabia, in 2005, the rest of the world had no spare capacity. If there were sudden surges in demand (high economic growth) or distributions in supply of other exporters (the Iraq War in 2003, Venezuela strikes in 2004), will producers be able to meet such shortage?

- **Elasticity in importer conservation, efficiency, and alternative supply and time/uncertainty lags:** One of the flaws of the current forecasts by the EIA, IEA, and OPEC is that they do not take into account changes in the elasticity of supply and demand. Long-term and mid-term elasticities have an impact on the demand, supply, and price, which in turns changes investment incentives and production capacity.

- **Producablilty at given prices:** Some experts have argued that the "easy oil" era is over. Oil recovery is more costly, and the price of oil has to be high enough to cover variable, fixed, and sunk costs and investment, but not too high that it exerts downward pressure on demand.

- **Technological gain in the upstream & downstream sector:** Current production capacity forecasts do not and may not be able to anticipate technological gains in the upstream side of the industry, especially demand-driven models. Producers strive to improve efficiency by investing in R&D and new technological innovations, but it remains uncertain how much, how, and when these technological gains may bear fruits in terms of real-world change in the level of recovery.

- **The "sustainable" inflow of foreign investment:** Natural depletion of current oil fields is inevitable. Expansion programs, therefore, are needed to replenish this natural decline, but developing countries are in need of foreign investment in terms of both capital and technological sharing. The lacks of security and stability, rigid foreign investment and tax laws, and limited transparency have prevented the inflow of much needed foreign investment into developing countries.

Estimates of near term spare capacity are increasingly uncertain and inevitably differ. According to the IEA, in early 2005, OPEC had 1.92-2.42 MMBD spare capacity, but according to the EIA, it had 1.1-1.6 MMBD. In both cases, practically all of the spare capacity was from Saudi Arabia. HETCO forecasted that in 2005, OPEC would increase its production by 0.70 MMBD. Again, most of the increase will depend on Saudi Arabia's ability to increase its capacity. HETCO forecasted an increase in Saudi production capacity from 10.68 to 11.15 MMBD.[viii]

Solving Supply Issues Relating to Middle Eastern Oil

The potential impact of high oil prices in easy the strain on world oil supplies becomes clearer when one looks at the impact of oil prices on the need for Middle East and North Africa (MENA) conventional oil production capacity.

- The *IEO2004* called for major increases in MENA oil production capacity. It forecast that Saudi Arabia's production capacity in 2025 would be 31.5 MMBD for the low price case, 22.5 MMBD for the reference case, and 16.0 MMBD for the high price case.

- The *IEO2005* forecasts that conventional MENA production capacity in 2025 will be 51.1 MMBD for the low price case, 39.5 MMBD for the reference case, and only 28.1 MMBD for the high price case.

These contrasts are even more striking for Saudi Arabia. For many years, most of OPEC's projected increase in production capacity in both the EIA and IEA models has been driven by Saudi Arabia. In recent times, the Saudi production capacity has received a lot of attention. Some analysts have questioned the Kingdom's ability to meet sudden surges in demand because of its lack of spare production capacity, and others – like

Matthew Simmons – have estimated that Saudi production may be moving towards a period of sustained decline.

In 2002, Saudi Arabia had an oil production capacity of 9.2 MMBD. This capacity was roughly 9.0-10.5 MMBD in 2004, and has so far averaged 10.5-11 MMBD in 2005. Like most of its predecessors, the *IEO* analysis for 2004 called for truly massive increases in Saudi oil. It forecast that Saudi Arabia's production capacity in 2025 would be 31.5 MMBD for the low price case, 22.5 MMBD for the reference case, and 16.0 MMBD for the high price case.

Te *IEO2005* forecasts that Saudi Arabia's production capacity in 2025 will be 20.4 MMBD for the low price case, 16.3 MMBD for the reference case, *but only 11.0 MMBD for the high price case*. *Yet, Saudi Arabia already plans to increase its production capacity to 12.5 MMBD by 2009.*

Most analysts, including current and former Saudi Aramco officials, believe that the 20.0 MMBD is an unattainable production capacity. At this point, one can argue that the Kingdom could reach this production capacity only if two things happen: there are major technological breakthroughs that enhance recovery of existing oil fields or help find new reservoirs and there are major supply disruptions that forces Saudi Arabia to meet the shortages in supply.

General Patterns of Oil Dependence

The US and China are key "drivers" in the increasing demand for energy imports and production capacity in most models. However, current models project that African and Middle Eastern imports could double by 2025. India could emerge as a major new importer, as could other Asian states. Russia could increase domestic consumption sharply in ways that would reduce its exports. Western Europe and Japan are the only major importers not projected to make massive increases in potential demand. Once again, however, the failure to model the high prices or examine supply by supply by supplier nation in credible terms, leaves massive uncertainties.

US Import Dependence

The US has become progressively more dependent on both a growing volume of imports and steadily growing imports from troubled countries and regions. Direct US petroleum imports increased from an annual average of 6.3 MMBD in 1973, to 7.9 MMBD in 1992 to 11.3 MMBD in 2002, and 12.9 MMBD in 2004. Some 2.5 MMBD worth of US petroleum imports came directly from the Middle East in 2004.[ix] Additionally, the average US petroleum imports from the Persian Gulf alone equaled 2.3 MMBD in the first 6 months of 2005, 2.4 MMBD in 2004, 2.5 MMBD in 2003, 2.2 MMBD in 2002, 2.7 MMBD in 2001, and 2.4 MMBD in 2000.[x]

If one looks at OPEC exports as a percent of US imports, these ranged from 47.8% in 1973, and 51.9% MMBD in 1992, to 39.9% MMBD in 2002, and 43.6% MMBD in 2004. If one looks at Gulf exports as a percent of US imports, these ranged from 13.6% in 1973, and 22.5% MMBD in 1992, to 19.7% MMBD in 2002, and 19.3% MMBD in 2004.

Future US gross petroleum imports will vary sharply according to price. If prices are low ($20.99/barrel), imports rise to 47.86 MMBD in 2025. If prices are moderate ($30.31/barrel), US gross petroleum imports are still 43.43 MMBD. If prices rise to $39.87/barrel, however, US imports are only 38.87 MMBD, and they would be far lower at $50, $60, $70, or more per barrel. Even the "high price" case leaves the US with nearly 60% dependence on oil imports in 2025, but the impact of this dependence on world supply is far lower than if oil prices are low or moderate. The EIA estimates of future US imports indicate that moderate oil prices will lead to major increases in US imports from the Gulf (from 2.5 MMBD in 2000 to 6.0 MMBD in 2025), the Americas (from 3.1 MMBD in 2000 to 5.0 MMBD in 2025), and "other" including North Africa (from 2.7 MMBD in 2000 to 6.2 MMBD in 2025).

The size of direct US imports of petroleum is only a partial measure of US strategic dependence on imports. The U.S. economy is dependent on energy-intensive imports from Asia and other regions, and what comes around must literally go around. While the EIA and IEA do not make estimates of indirect imports of oil from the Gulf and other regions in terms of the energy required to produce the finished goods, the US imports them from countries that are dependent on Middle Eastern exports, analysts guess that they would add at least 1.0 MMBD to total US oil imports.

The failure of the DOE and the EIA to explicitly model such indirect imports, and their steady growth, is a long-standing and critical failure in US energy analysis and policy. It seems almost certain that the that the future increase in such indirect imports will, for example, vastly exceed any benefits in increased domestic energy supply that will result from the energy bill just passed by the US Congress in the summer of 2005.

Surge in Chinese and Indian Demand for Oil

According to China's state media reports, China imported 79.9 million tons of oil in first three quarter of 2004, which represented a 40% increase from the first eight months of 2003.[xi] In 2002, China consumed 5.0 MMBD. According to EIA 2005 high price estimates, this number *could* triple by 2025 (12.50 MMBD for the low price case, 14.50 MMBD reference case, and 16.1 MMBD for the high price case).[xii]

According the BP *Statistical Review of World Energy 2005*, Chinese imports totaled 3.40 MMBD in 2004. China imported 0.15 MMBD from the US, 0.038 MMBD from South and Central America, 0.052 MMBD from Europe, 0.365 MMBD from the FSU, 1.264 MMBD from the Middle East, 0.709 MMBD from Africa, 0.045 MMBD from Australasia, 0.044 MMBD from Japan, 0.824 from other Asia Pacific, and 0.010 MMBD from others.[xiii]

China's domestic production could reach 3.8 MMBD in 2020, but its demand is likely to be more than three times as high.[xiv] During 2004, China imported 40% of its oil consumption, despite the fact that it produced 174 million tons of oil during the whole year. Some experts believe that recent high oil prices can provide the right incentives for investment into new technologies to enhance recovery and exploration and increase China's domestic output, and reduce reliance on oil imports.[xv]

There is also the "India factor." Oil composes 30% of India's energy consumption, but the country has only 5.4 billion barrels of oil.[xvi] India in 2001 consumed 2.1 MMBD, 2.2

MMBD in 2003, and according to the EIA's reference case forecast Indian consumption will reach 2.67 MMBD in 2010 and double to as high as 4.9 MMBD in 2025.[xvii]

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[i] WTI Crude oil spot price, adapted from the EIA historical database, available at: http://www.eia.doe.gov/oil_gas/petroleum/info_glance/prices.html

[ii] John J. Fialka, "Search for Crude Comes With New Dangers," *Wall Street Journal*, April 11, 2005.

[iii] EIA, *International Energy Outlook 2005*, July 2005, Pages 2-3.

[iv] See http://www.eia.doe.gov/emeu/cabs/pgulf.html, DOE/EIA estimated in September 2004 that the Persian Gulf contains 715 billion barrels of proven oil reserves, representing over half (57%) of the world's oil reserves, and 2,462 Tcf of natural gas reserves (45% of the world total). In addition, at the end of 2003, Persian Gulf countries maintained about 22.9 MMBD of oil production capacity, or 32% of the world total. Perhaps even more significantly, the Persian Gulf countries normally maintain almost all of the world's excess oil production capacity. As of early September 2004, excess world oil production capacity was only about 0.5-1.0 MMBD, all of which was located in Saudi Arabia.

According to the Energy Information Administration's *International Energy Outlook 2005's* reference case forecast, Persian Gulf oil production increased from 18.7 MMBD in 1990 to 22.4 MMBD in 2001 to 20.7 MMBD. It is expected to reach about 28.3 MMBD by 2010, and 35.2 MMBD by 2020, and 39.3 MMBD in 2025.

The estimate, however, does change in the high oil price case: it is expected to reach about 24.4 MMBD by 2010, and 26.2 MMBD by 2020, and 27.8 MMBD in 2025.

[v] EIA, *Monthly Energy Review*, March 2005, Page 149

[vi] Edward Morse and Thomas Stenvoll, "The New Supplier(s) of Last Resort," *Weekly Market Review*, Hess Energy Trading Company, LLC, April 1, 2005.

[vii] EIA, *International Energy Outlook 2005*, July 2005, Page 26.

[viii] Edward Morse and Thomas Stenvoll, "The New Supplier(s) of Last Resort," *Weekly Market Review*, Hess Energy Trading Company, LLC, April 1, 2005.

[ix] BP, *Statistical Review of World Energy 2005*, June 2003, Page. 17.

[x] EIA, "Petroleum Imports from Qatar, Saudi Arabia, U.A.E. and Total Persian Gulf," *Monthly Energy Review*, August 2005, available at http://www.eia.doe.gov/emeu/mer/pdf/pages/sec3_9.pdf

[xi] "China reports soaring oil imports," *BBC News*, available at: http://news.bbc.co.uk/1/hi/business/3654060.stm

[xii] EIA, *International Energy Outlook 2005*, July 2005.

[xiii] BP, *Statistical Review of World Energy 2005*, June 2005, Page 18.

[xiv] Jin Liangziang, "Energy First: China and the Middle East," *Middle East Quarterly*, Spring 2005, available at: http://www.meforum.org/article/694

[xv] "China to control its reliance on oil imports," *Xinhua*, April 23, 2005, available at: http://www2.chinadaily.com.cn/english/doc/2005-04/23/content_436862.htm#

[xvi] EIA, Country Analysis Brief, "India," available at: http://www.eia.doe.gov/emeu/cabs/india.html

[xvii] EIA, *International Energy Outlook 2005*, July 2005.