The Other "Pivot to Asia" - The Shifting Strategic Importance of Gulf Petroleum

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It is all too easy to focus on energy developments in the US and lose sight of the overall pattern of changes in world energy production and consumption. The fact is, however, that the Department of Energy does not forecast US energy independence in its reference case – only a dip to 37% dependence by 2040. It does not mean that the US is free of the need to pay world oil prices in a crisis. Far more important, the US already imports some $2.4 trillion dollars worth of goods to sustain a $14 trillion economy, and some $1.2 trillion of these steadily rising imports are independent on the flow stable of MENA, and particularly Gulf, oil and gas exports to Europe and Asia.

This is why the US role in the Gulf – caught between US power projection across the Atlantic and Mediterranean and across the Pacific and Indian Ocean is so important. One of the most critical roles the US plays in serving its global strategic interests comes from securing this flow of oil – and from ensuring that no other outside power like China assumes this role.

Here, it becomes critical to examine the pattern of Gulf, MENA, and world exports and why these patterns are so important to US strategic interest. Both the US Energy Information Agency (EIA) and International energy Agency (IEA) forecast increases in Gulf production that will be accompanied by radical increases in the flow of Gulf petroleum exports to Asia.

The Petroleum Pivot to Asia

While US and European demand shaped the follow of Gulf oil exports through the IOR in the past, South and East Asian states that dominate this flow and Asia will become steadily more dependent on Gulf petroleum exports to or through the IOR.[1] This will have a major impact on the overall flow of shipping in the IOR and in the importance of both maritime security and the region's strategic chokepoints.

There are many uncertainties in any estimate of how sharp the rise will be in Asian dependence, or to predict the future of either alternative liquids or the extent transportation technology will remain dependent on petroleum. It seems highly unlikely, however, that massive changes could penetrate heavily into global or Asia markets, and the EIA seems optimistic in estimating the impact of increases in energy efficiency, conservation, and alternative liquid fuels.

Virtually all energy projections indicate that nations like India and China – as well as Asia's developed states like Japan and South Korea will experience a sharp increase in strategic dependence at a time when the US will may be able to depend largely no north /American production and European demand will remain relatively constant in comparison with Asia and will benefit from increase production in North Africa and areas like the Caspian.

Asia, Not the US or Europe, Will Dominate Demand for Petroleum Liquids

The EIA estimate is broadly similar to IEA and OPEC forecasting in indicating that Asia, and particularly the emerging economies in Non-OECD Asia – such as China and India – will increase demand for world petroleum and other liquid fuels consumption from 87 million barrels per day in 2010 to 97 million barrels per day in 2020, and 115 million barrels per day in 2040, in spite of a prediction that prices will rise steadily after 2020.[2]

The importance of the rise in Asia petroleum demand, is shown in **Figure 1.** This Figure not only shows how much non-OECD Asia will drive the rise in demand and supply, shows that almost all of this rise in demand must be met from outside the region and from the Gulf. [3]

The EIA summarizes the reason for this growing Asian dependence on Gulf petroleum as follows:[4]

> Non-OECD Asia is the largest source of growth in worldwide liquids consumption in the *IEO2013* Reference case, increasing by 19.3 million barrels per day from 2010 to 2040 (Figure 37). Within non-OECD Asia, China has the largest absolute growth in demand from 2010 to 2040 (10.5 million barrels per day), and India has the second largest (5.0 million barrels per day). India has the fastest regional GDP growth in the *IEO2013* Reference case, which translates into the fastest regional growth in liquids demand (3.1 percent per year), although the absolute growth in India's liquids consumption is smaller than China's. In 2010, India's liquids fuel use was 35 percent of China's 9.3 million barrels per day; in 2040 India's liquids consumption is 42 percent of China's 19.8 million barrels per day.
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> As China's economy moves from dependence on energy-intensive industrial manufacturing to a more service-oriented economy, the transportation sector becomes the most important source of growth in liquid fuels use. China more than doubles its liquids consumption compared with the 2010 level, and it supplants the United States as the world's largest consumer of liquid fuels in the Reference case after 2035.
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> In India, petroleum consumption is heavily oriented toward diesel fuel, which represented about 42 percent of product volume in 2012. Diesel, which is used in transportation, irrigation, manufacturing, and electricity generation, has historically received significant government subsidies. In an effort to reduce budget and trade deficits, the Indian government raised diesel prices by 14 percent in late 2012, its largest price hike ever.
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> With liquids consumption growth rapidly outpacing production, non-OECD Asia has increasingly relied on imports from the Persian Gulf. In 1990, 33 percent of non-OECD Asia's oil imports came from the Middle East; in 2010, 48 percent came from the Middle East. This trend will likely continue in the future, with producers in Russia and Central Asia also increasing production in the eastern regions of the two countries to meet new Asian demand.
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> Liquids demand in the Middle East also grows substantially in the *IEO2013* Reference case, increasing by 3.2 million barrels per day from 2010 to 2040 as a result of strong population growth rates, which are second only to Africa, and rising incomes. Liquids-intensive industrial demand also plays a major role in the region, with consumption in the chemical sector leading industrial demand growth. Delays in petroleum subsidy reforms outside Iran also support higher regional consumption, coupled with per capita income growth that supports a significant expansion within the transportation sector. In the later years of the projection, it is likely that some subsidy reform will occur and begin to slow the growth in demand for liquids.

The IEA makes similar estimates. The Executive Summary of the IEA report a notes that global energy demand for oil exports will rise steadily in spite of any shifts in North American – China will increase its use of oil by as much as 66% between 2011 and 2030

and India will increase dependence by more than 100%. Moreover, the world will become even more dependent on the Gulf after 2020, [5]

> Growth in oil consumption in emerging economies, particularly for transport in China, India and the Middle East, more than outweighs reduced demand in the OECD, pushing oil use steadily higher in the New Policies Scenario. Oil demand reaches 99.7 mb/d in 2035, up from 87.4 mb/d in 2011, and the average IEA crude oil import price rises to $125/barrel (in year-2011 dollars) in 2035 (over $215/barrel in nominal terms). The transport sector already accounts for over half of global oil consumption, and this share increases as the number of passenger cars doubles to 1.7 billion and demand for road freight rises quickly.
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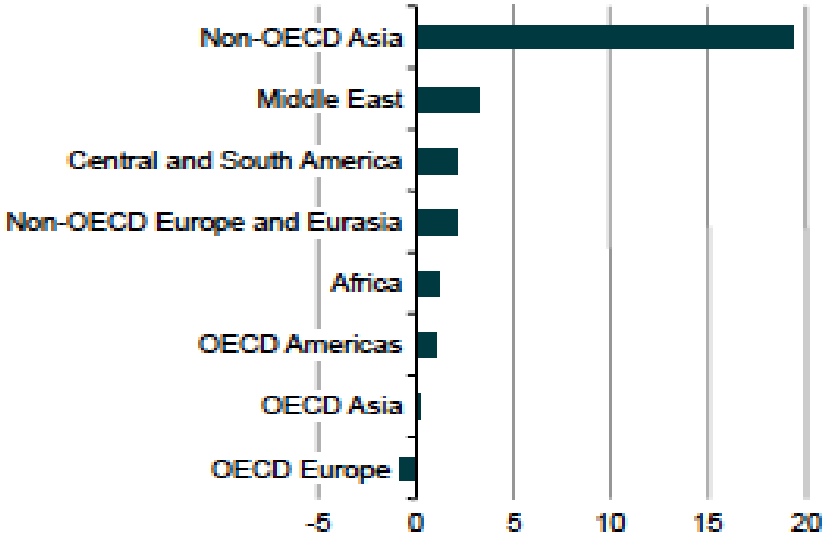
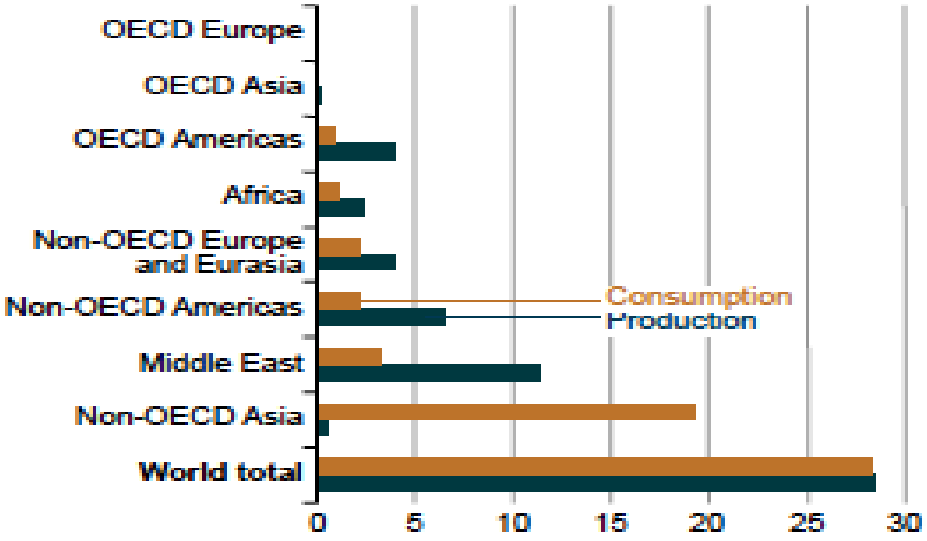
> The latter is responsible for almost 40% of the increase in global oil demand: oil use for trucks – predominantly diesel – increases much faster than that for passenger vehicles, in part because fuel-economy standards for trucks are much less widely adopted. Non-OPEC oil output steps up over the current decade, but supply after 2020 depends increasingly on OPEC. A surge in unconventional supplies, mainly from light tight oil in the United States and oil sands in Canada, natural gas liquids, and a jump in deepwater production in Brazil, push non-OPEC production up after 2015 to a plateau above 53 mb/d, from under 49 mb/d in 2011. This is maintained until the mid-2020s, before falling back to 50 mb/d in 2035.
>
> Output from OPEC countries rises, particularly after 2020, bringing the OPEC share in global production from its current 42% up towards 50% by 2035. The net increase in global oil production is driven entirely by unconventional oil, including a contribution from light tight oil that exceeds 4 mb/d for much of the 2020s, and by natural gas liquids. Of the $15 trillion in upstream oil and gas investment that is required over the period to 2035, almost 30% is in North America.
>
> Iraq makes the largest contribution by far to global oil supply growth. Iraq's ambition to expand output after decades of conflict and instability is not limited by the size of its resources or by the costs of producing them, but will require coordinated progress all along the energy supply chain, clarity on how Iraq plans to derive long-term value from its hydrocarbon wealth and successful consolidation of a domestic consensus on oil policy. In our projections, oil output in Iraq exceeds 6 mb/d in 2020 and rises to more than 8 mb/d in 2035. Iraq becomes a key supplier to fast-growing Asian markets, mainly China, and the second-largest global exporter by the 2030s, overtaking Russia. Without this supply growth from Iraq, oil markets would be set for difficult times, characterized by prices that are almost $15/barrel higher than the level in the New Policies Scenario by 2035.

Figure 1: EIA Estimate of the Key Trends in World Liquids Consumption: 2010-2040.

Change in world liquids consumption by region, 2010-2040 (million barrels per day) (p. 23)



Change in world liquids production and consumption by region, 2010-2040 (million barrels per day) (p. 27)



Source: EIA, *International Energy Outlook, 2013*, DOE/EIA-0484 (2013, July 2013, pp. 23 and 27

Smaller, but Significant Increases in Asia Demand for Rising Gulf Gas Production

The impact that the trends in natural gas production, and trade, will have on the IOR are more uncertain, given the rapidly changing technologies involved and the uncertainty in estimating gas reserves. **Figure 2** is probably broadly correct, however, in estimating that most of the estimated increase in gas production comes from within the Gulf. Rises in Australian and New Zealand trade will play a role in meeting East Asia demand, but India, other Asia, and East African trade will make only small increases or decline.

Figure 2: EIA Estimate of Trends in Gulf Natural Gas Production: 2010-2040

(In trillions of cubic feet)

Region/Country	2010	2015	2020	2025	2030	2035	2040
Australia/New Zealand	1.9	2.7	3.8	4.9	5.6	6.3	6.7
India	1.8	1.6	1.7	1.8	2.1	2.6	3.0
Other Asian Production	4.2	3.9	3.8	3.7	3.7	3.8	3.9
East Africa	0.1	0.2	0.5	0.5	0.6	0.7	0.8
Iran	5.2	6.4	7.5	8.5	9.4	10.1	10.6
Iraq	0.0	0.1	0.1	0.3	0.6	0.8	1.2
Saudi Arabia	3.1	3.2	3.6	4.0	4.5	4.9	5.4
Other Middle East	0.3	0.3	0.3	0.2	0.2	0.2	0.2

Source: EIA, *International Energy Outlook, 2013*, DOE/EIA-0484 (2013, July 2013, pp. 283-286.

The EIA estimates shown in **Figure 3** reflect growth in two different subregions. The first is in Australia, New Zealand and Oceania that will do much to reduce their energy imports: [6]

> Natural gas production in the Australia/New Zealand region grows from 1.9 trillion cubic feet in 2010 to 6.7 trillion cubic feet in 2040 in the Reference case, an average rate of 4.3 percent per year. In 2010, Western Australia, including the Northwest Shelf area of Australia's Carnarvon Basin, accounted for around 63 percent of total production in the Australia/New Zealand region [*79*], with much of the production used as feedstock at the Northwest Shelf LNG liquefaction facility. Other areas and basins in Australia provided another 28 percent of the region's total production in 2010. New Zealand's natural gas production accounted for around 9 percent of the 2010 regional total.
>
> Coalbed methane from the Bowen-Surat Basin in eastern Australia accounted for between 10 percent and 11 percent of Australia's total natural gas production in 2010 [*80*], and its share grows as it provides natural gas supplies to satisfy the area's demand growth and to feed proposed LNG export projects. Several companies also are pursuing tight gas and shale gas resources in Australia. Both the Perth and Canning basins in the state of Western Australia may hold economically producible resources of tight gas and shale gas. As in the United States, fracture stimulation of oil and gas wells has been common since long before the current interest in shale gas production. In Western
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> Australia almost 800 wells have been stimulated by hydraulic fracturing since 1958, including several in the Perth Basin in 2011 and 2012 [*81*] as part of shale gas exploration efforts there. The Canning Basin has received less attention to date, as it is more remote and will require greater infrastructure investment to bring producible resources, if any, to market. On the other hand, shale gas development in Australia is most active in the Cooper Basin, which lies mainly in the state of South Australia and closer to existing oil and gas infrastructure and to Australia's demand centers.

The second major increase in production again comes from the Gulf subregion, but aside from Qatar, the EIA much of it will be used domestically:[7]

> Four major natural gas producers in the Middle East—Qatar, Iran, Saudi Arabia, and the United Arab Emirates—together accounted for 85 percent of the natural gas produced in the Middle East in 2010. With more than 40 percent of the world's proved natural gas reserves, the Middle East accounts for 21 percent of the total increase in world natural gas production in the *IEO2013* Reference case, growing from 15.9 trillion cubic feet in 2010 to 31.5 trillion cubic feet in 2040 (Figure 54).
>
> The strongest growth …from 2010 to 2040 in the Reference case comes from Iran, where natural gas production increases by 5.4 trillion cubic feet, followed by Qatar (4.9 trillion cubic feet of new production) and Saudi Arabia (2.3 trillion cubic feet). Although Iraq is the region's fastest-growing supplier of natural gas, with average increases of 11.6 percent per year over the projection, it remains a relatively minor contributor to regional natural gas supplies. In 2040, Iraq's natural gas production totals 1.2 trillion cubic feet, or about 4 percent of the Middle East total.
>
> Iran has the world's second-largest reserves of natural gas, after Russia, and is currently the Middle East's largest natural gas producer. Iran is also the Middle East's largest user of reinjected natural gas for enhanced oil recovery operations. In 2010 Iran reinjected more than 1 trillion cubic feet of natural gas, or 15 percent of its gross production, and in 2020 it is projected to use 3.7 trillion to 7.3 trillion cubic feet of natural gas per year for reinjection [*82*]. The higher estimate is almost equal to the total for Iran's marketed natural gas production in 2020 in the *IEO2013* Reference case. The actual figure for reinjection use, whatever it turns out to be, will have a significant impact on Iran's marketed natural gas production in the future.
>
> Natural gas production in Saudi Arabia grows by an average of 1.9 percent per year, from 3.1 trillion cubic feet in 2010 to 5.4 trillion cubic feet in 2040. The Saudi Arabian national oilcompany, Saudi Aramco, has made several natural gas finds in the Persian Gulf that are not

> associated with oil fields. Three gas fields, the Karan, Arabiyah, and Hasbah, are expected to begin producing in the next 5 years, adding at least 1.3 trillion cubic feet of production when fully operational. Both Arabiyah and Hasbah are offshore, and both are sour natural gas fields, making them relatively expensive to produce, especially in the context of low domestic natural gas prices set by the government. The *IEO2013* Reference case assumes that
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> Saudi Arabia's policy of reserving natural gas production for domestic use will persist throughout the projection period, and that no natural gas will be exported. Thus, in the long term, production is more dependent on domestic demand growth and domestic prices than on resource availability.

In contrast there is little growth in conventional natural gas production in East Africa, India, and the rest of the IOR, while demand will increase significantly in China and India. However, China will be able to make major increases in production by shifting to unconventional natural gas resources. [8]

> In 2010, East Africa produced just 0.1 trillion cubic feet of natural gas. Over the last few years, however, several new natural gas discoveries have been made in the Rovuma Basin off the coast of Mozambique and Tanzania. Anadarko Petroleum began exploration of the Rovuma Basin in 2006, and several other companies have since invested and made discoveries in the area as well. Recent offshore discoveries in Mozambique and Tanzania hold an estimated 85 trillion cubic feet and 18 trillion cubic feet of recoverable natural gas resources, respectively. In order to commercialize the resources, Anadarko and another company, Eni, have proposed separate LNG liquefaction facilities for Mozambique. In addition, BG and Statoil are discussing the possibility of a joint facility in Tanzania. The Anadarko proposal, which currently is the most advanced, is for a facility capable of exporting 0.5 trillion cubic feet per year initially, with room to increase the capacity to a total of 1.4 trillion cubic feet if more natural gas becomes available for the project
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> …Both Japan and South Korea have limited natural gas resources and, consequently, very limited current and future production. Both countries receive the vast majority of their natural gas supplies in the form of imported LNG. In 2010, natural gas production in Japan and South Korea accounted for only 4 percent and 2 percent of their natural gas consumption, respectively. The presence of substantial deposits of methane hydrates in both Japan and South Korea has been confirmed, and both countries are investigating how those resources could be safely and economically developed. However, the *IEO2013* Reference case does not include methane hydrate resources in its estimates of natural gas.
>
> Natural gas production in non-OECD Asia increases by 9.7 trillion cubic feet from 2010 to 2040 in the *IEO2013* Reference case, with China accounting for 70 percent of the growth and India 12 percent (Figure 57). From 2010 to 2040, China has the largest increase in natural gas production in non-OECD Asia, from 3.3 trillion cubic feet in 2010 to 10.1 trillion cubic feet in 2040, for an average annual increase of 3.8 percent. Much of the increase in the later years comes from tight gas, shale gas, and coalbed methane reservoirs
>
> China already is producing small volumes of coalbed methane and significant volumes of tight gas. However, the actual volumes of tight gas are unknown, as China does not report it separately. China is trying to encourage the development of coalbed methane resources. Toward that goal, it has been offering producers a subsidy of roughly $1 per million Btu since 2008 and may increase it to just over $3 per million Btu [*91*]. In addition, there has been great interest in China's potential for shale gas production. China held its first auction for shale gas exploration blocks in June 2011, awarding contracts for four blocks, and in December 2012 it awarded another 19 shale gas blocks in a second auction [*92*]. In addition, China is considering offering a subsidy of around $2 per million Btu for shale gas produced before 2015 [*93*].
>
> Natural gas production in India grows at an average annual rate of 1.6 percent over the projection period, from 1.8 trillion cubic feet in 2010 to 3.0 trillion cubic feet in 2040. Production at the Dhirubhai-6 block in the Krishna Godavari Basin began in April 2009 and was a major factor in increasing India's natural gas production by more than 60 percent between 2008 and 2010.
>
> However, India faces several production challenges. A large portion of its current production

> comes from aging western offshore fields; production from the Krishna Godavari Basin has failed to meet earlier expectations for volumes [*94*]; and while India has been encouraging exploration of potential coalbed methane deposits, initial results have been discouraging and actual production is likely to fall short of the government estimate of 0.1 trillion cubic feet by 2013-2014 [*95*].
>
> India does have several basins that are prospective for shale gas, and in the later years of the *IEO2013* Reference case production from shale resources makes a significant contribution to India's total natural gas production. According to most of the early estimates India's shale resources are much smaller than those in China or North America, and India appears to be progressing toward their development much more slowly [*96*].
>
> Outside China and India, non-OECD Asian natural gas production grows at a relatively modest average annual rate of 0.6 percent. The two largest producers in the region, Malaysia and Indonesia, both face declining production from many older fields and must make substantial investments to maintain current production levels. While other countries are looking toward potential shale gas resources to underpin future production growth, Indonesia is focusing on its coalbed methane resources. As of late 2012,
>
> Indonesia had awarded 50 production-sharing contracts for coalbed methane areas [*97*]. The sector has attracted investment from a variety of companies, including large international oil and natural gas companies, smaller regional companies, and local Indonesian companies. At least three projects are expected to be producing commercial volumes in 2013. In 2011, the Indonesian firm Medco Energi signed an agreement to sell small volumes of coalbed methane from its Sekayu development to a local power generator beginning in 2012 [*98*]. Dart Energy, an Australia-based company that specializes in coalbed methane, expects to make the first sales of natural gas from its Sangatta project in 2013 [*99*]. Vico Indonesia, a BP-Eni joint venture, also expects first sales of natural gas from its Sanga-Sanga project in 2013, although first production from the project began in 2011 [*100*].

Given these data and estimates, it seems likely that gas production and exports from the Gulf subregion will grow, but have far less global economic effect, and strategic effect on the IOR, than the growth in petroleum liquids and other exports. The EIA summarizes the export impact of IOR gas production as follows:[9]

> Net exports of natural gas from the Middle East grow at an annual rate of 3.0 percent, as flows from the region increase from 2.7 trillion cubic feet in 2010 to 6.7 trillion cubic feet in 2040…
>
> An important factor in the increase, particularly with regard to brisk growth in volumes in the near term, is the rise of LNG supplies from Qatar, which went from exporting its first LNG in 1999 to being the largest LNG exporter in the world in 2009. Qatar's LNG exports continue to increase through 2040. Its total LNG export capacity reached 77 million tons (3.6 trillion cubic feet) per year in early 2011 with the completion of the last in a line of six large-volume liquefaction trains under construction since 2008. Each train has the capacity to produce the equivalent of 360 billion cubic feet of natural gas per year for export…
>
> Qatar's natural gas exports grow by an average of 10.7 percent per year from 2010 to 2015 in the Reference case, then slow to an average increase of 1.1 percent per year after 2015. Because of a current moratorium on further development from the North Field, no new LNG projects are being initiated. Qatar enacted the moratorium in 2005 in order to assess the effect of the ongoing increase
> in production on the North Field before committing to further production increases. If Qatar decides to lift the moratorium on North Field development in 2014, its stated development priority is to ensure that it can meet long-term domestic natural gas needs for power generation, water desalination, and local industry. Only after those needs are met will it consider further increases in exports, and any increases are expected to come primarily from optimization of current facilities.
>
> Despite possessing the second-largest reserves of natural gas in the world, Iran continues to struggle with the formation of an export program that will result in significant commercialization of its resources. The country shares the North Field/South Pars Field with Qatar and has many

> export projects under consideration through the development of its portion of those reserves.
>
> Nonetheless, the country as of 2010 was just barely a net exporter, delivering slightly higher volumes of natural gas to Turkey than it received from Turkmenistan (resulting in net exports of 0.1 trillion cubic feet). Although its first LNG export plant is under construction, Iran is without international partners and without an obvious source for obtaining liquefaction technology. Other export projects continue to be discussed, but as a result of international sanctions and internal politics there has been little progress on most projects. The *IEO2013* Reference case shows moderate flows from Iran, so that by 2040 the country is a net exporter of 1.6 trillion cubic feet per year.
>
> Elsewhere in the Middle East, Yemen, Oman, and Abu Dhabi in the United Arab Emirates (UAE) also currently export LNG, although the potential for growth in exports from those and other countries in the Middle East appears to be limited by the growth of their domestic demand. Significant volumes of LNG have been imported by Kuwait and also by Dubai in the UAE, which completed construction of an LNG import facility in November 2010 and received its first cargo a month later… Both Oman and the UAE also are currently importing natural gas via pipeline from Qatar. The *IEO2013* Reference case projects a similar trend for smaller producers in the Arabian Peninsula region as a whole, including Kuwait, Oman, the UAE, and Yemen. As a group they exported less than 0.2 trillion cubic feet of natural gas on a net basis in 2010, and the volume of their net imports rises throughout the projection to a total of 1.3 trillion cubic feet in 2040.

Figure 4 puts these trends in a broader global context. It provides a series of charts showing a striking rise in Gulf gas production, the lack of any significant rise in East African production, rises in Russian and Central Asian production that will feed key gas pipelines to both Europe and Asia and bypass the IOR, and finally the extent to which a high technology and relatively wealthy state like China could increase gas supply through exploiting unconventional natural gas resources.

In short, Asian gas exports from the Gulf subregion will play a growing role in meeting world demand, but have nothing like the impact of the export of petroleum liquids.

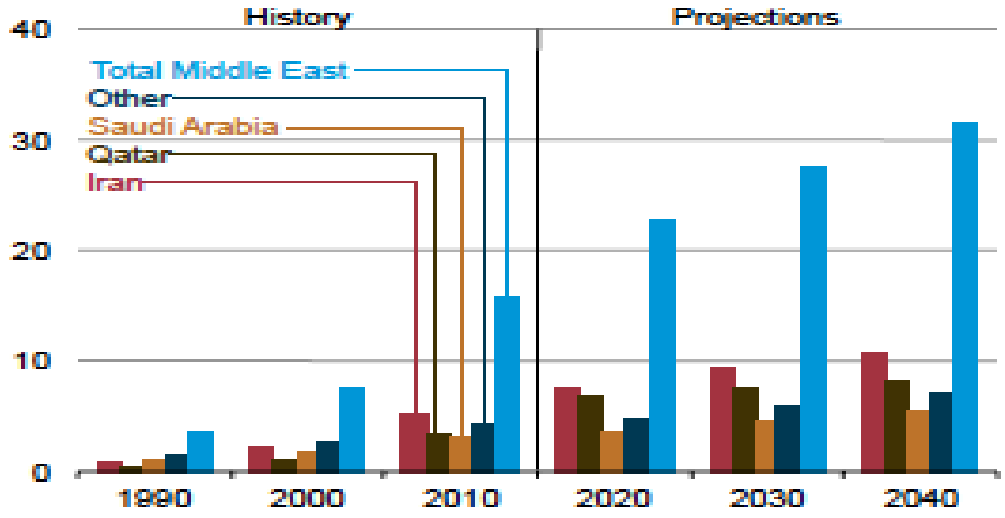
Figure 3: EIA Estimate of Key Trends in World Gas Production and Consumption: 2010-2040: Part One

World natural gas production by region and country in the Reference case, 2010-2040 (trillion cubic feet) (p. 50)

	History	Projections						Average annual percent change, 2010-2040
Region/country	2010	2015	2020	2025	2030	2035	2040	
OECD								
United States[a]	21.2	23.9	26.5	28.4	29.7	31.3	33.1	1.5
Canada	5.4	5.0	5.4	5.9	6.4	7.0	7.6	1.1
Europe	10.4	9.0	8.1	8.0	8.6	9.2	9.9	-0.2
Australia/New Zealand	1.9	2.7	3.8	4.9	5.6	6.2	6.7	4.3
Rest of OECD	2.1	1.7	1.8	1.9	2.3	3.0	3.8	2.1
Total OECD	**41.0**	**42.3**	**45.6**	**49.1**	**52.5**	**56.7**	**61.2**	**1.3**
Non-OECD								
Russia	20.9	21.6	23.6	26.3	29.4	32.1	33.3	1.6
Europe and Central Asia	5.8	7.4	8.4	9.3	10.3	11.4	12.3	2.6
Iran	5.2	6.4	7.5	8.5	9.4	10.1	10.6	2.4
Qatar	3.4	6.0	6.9	7.3	7.6	7.9	8.3	3.0
Rest of Middle East	7.3	7.7	8.4	9.5	10.5	11.4	12.6	1.8
North Africa	5.8	5.7	6.2	6.2	6.4	6.8	7.4	0.8
Rest of Africa	1.6	2.3	3.1	4.0	4.8	5.6	6.3	4.8
China	3.3	3.8	4.2	5.2	6.7	8.5	10.1	3.8
Rest of Asia	11.5	11.1	11.4	11.8	12.5	13.5	14.4	0.8
Central and South America	5.4	6.4	7.4	7.9	8.5	9.5	10.4	2.2
Total non-OECD	**70.2**	**78.5**	**87.1**	**96.0**	**106.2**	**116.8**	**125.6**	**2.0**
Total world	**111.1**	**120.8**	**132.7**	**145.1**	**158.7**	**173.5**	**186.8**	**1.7**
Discrepancy[b]	-1.8	0.4	0.6	0.9	0.5	0.8	0.6	

[a]Includes supplemental production, less any forecast discrepancy.
[b]Balancing item. Differences between global production and consumption totals result from independent rounding and differences in conversion factors derived from heat contents of natural gas that is produced and consumed regionally.

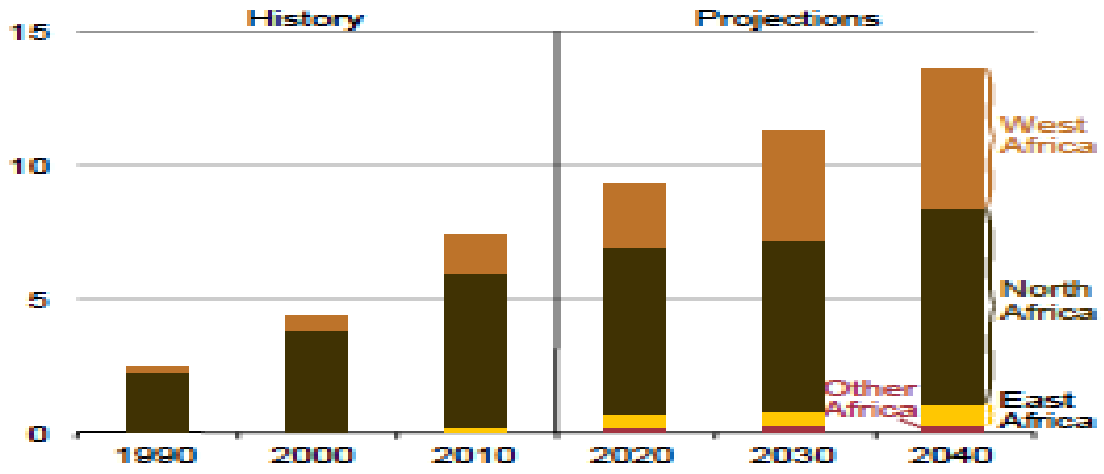
Middle Eastern Increases in natural gas production, 1990-2040 (trillion cubic feet) (p. 52)



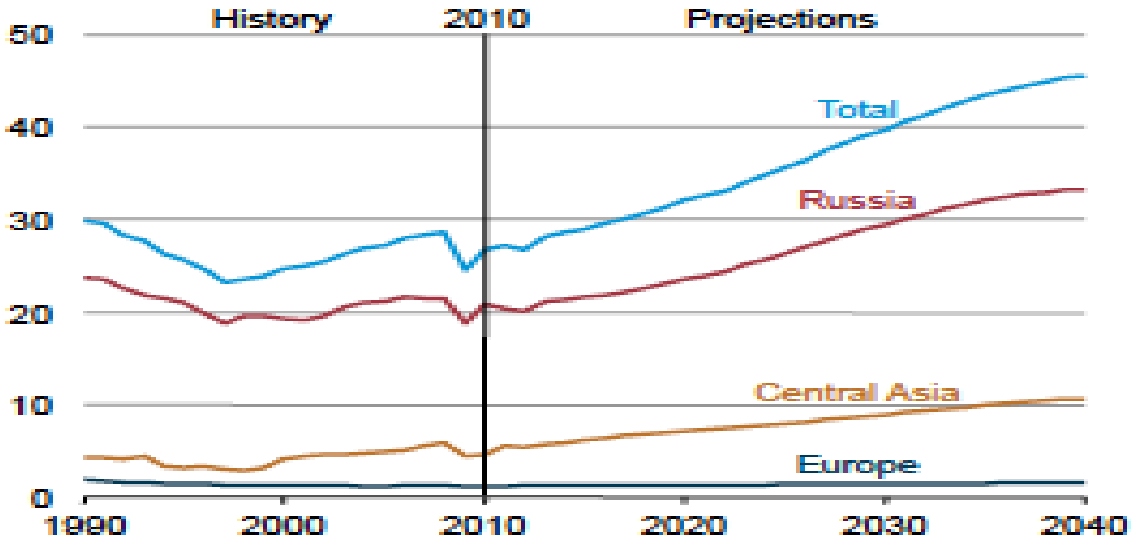
Source: EIA, *International Energy Outlook, 2013*, DOE/EIA-0484 (2013, July 2013, pp. 50-52.

Figure 4: EIA Estimate of Key Trends in World Gas Production and Consumption: 2010-2040: Part II

Lack of Increase Production in East Africa



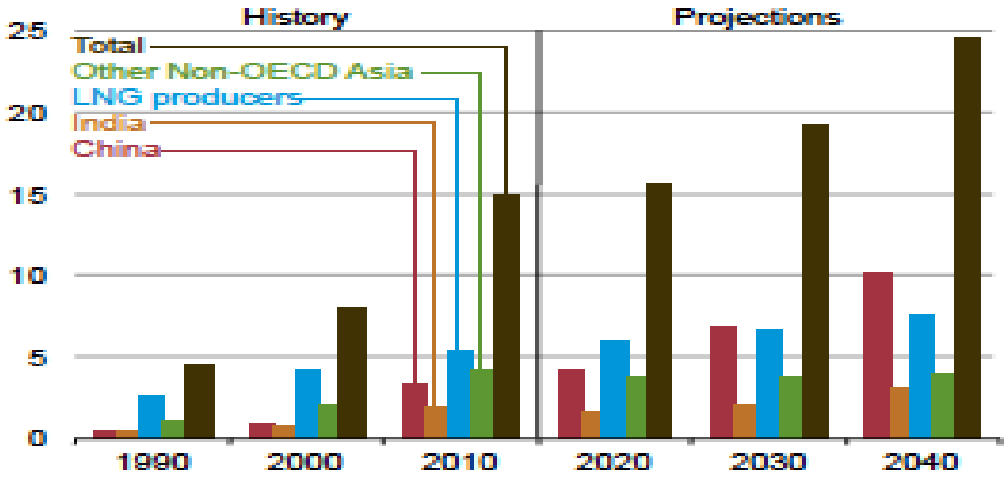
Rise of Russia and Central Asia as Gas Exporters



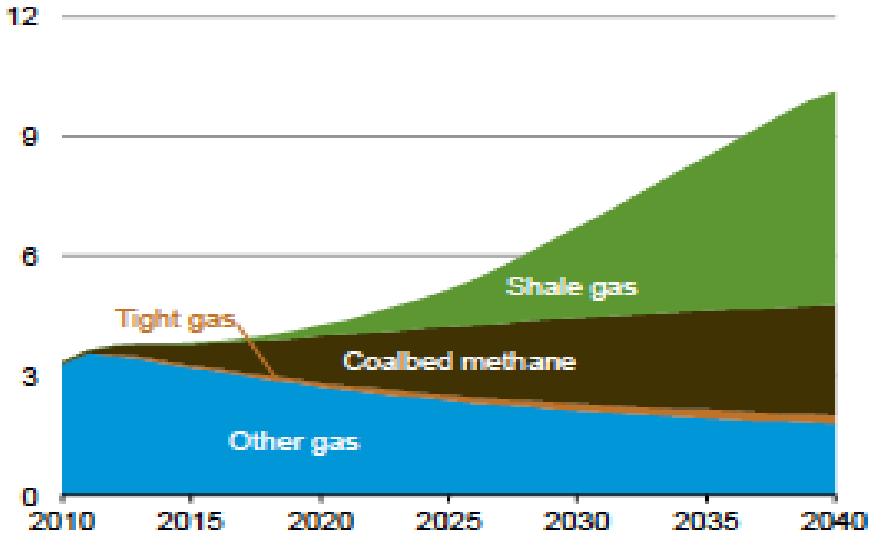
Source: EIA, *International Energy Outlook, 2013*, DOE/EIA-0484 (2013, July 2013, pp. 53-54.

Figure 5: EIA Estimate of Key Trends in World Gas Production and Consumption: 2010-2040: Part III

Asian Dependence on Asian LNG Producers



Possible Chinese Increase in Gas Production Using Unconventional Means



Source: EIA, *International Energy Outlook, 2013*, DOE/EIA-0484 (2013, July 2013, pp. 54.

[1] EIA states that, "the most significant non-OPEC contributors to production growth are Brazil, Canada, the United States, and Kazakhstan , which together account for 87 percent of the total increase in non-OPEC liquids supply. Prospects for growth in petroleum and other liquid fuels production in the Americas are particularly strong, reflecting contributions from deepwater pre-salt resources in Brazil, bitumen in Canada, and tight oil in the United States. The result is a net gain in non- OPEC production from the Americas of 7.2 million barrels per day by 2025—an increase that balances liquids production with consumption in the hemisphere as demand growth is tempered by efficiency gains, especially in the U.S. transportation sector. In the IEO2013Reference case, the Americas become a net exporter of liquids by the end of the projection period. There is potential for even more production growth in the Americas from both the United States, as discussed in the *Annual Energy Outlook 2013*

(AEO2013) High Oil and Gas Resource case, and from OPEC's Venezuela, which has large reserves of extra-heavy oil but does not aggressively develop new fields under the current policies assumption of the IEO2013 Reference case. U.S. production of liquid fuels surpasses that of Russia by 2015. There are a number of factors (including accounting conventions for how liquid fuels are measured) that determine the timing, extent, and significance of such a development.

[2] EIA, *International Energy Outlook*, 2013, 2013, p. 23

[3] EIA, *International Energy Outlook*, 2013, pp. 27-28.

[4] EIA, *International Energy Outlook*, 2013, 27-28.

[5] Executive summary, World Energy Outlook, IEA, Paris, November 2012, pp. 3-4, http://www.worldenergyoutlook.org/publications/weo-2012/#d.en.26099 . for a short commentary, see Floyd Norris, "Oil Supply is rising, But Demand Keeps Pace and Then Some," *New York Times*, November 24, 2012, p. B5.

[6] EIA, *International Energy Outlook*, 2013, pp. 51-53

[7] EIA, *International Energy Outlook*, 2013, pp. 51-53

[8] EIA, *International Energy Outlook*, 2013, pp. 51-53

[9] EIA, *International Energy Outlook*, 2013, pp. 59-60.