

## SATISFYING LONG TERM GLOBAL GAS DEMAND

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### The only viable fuel

Natural gas is used in the residential, commercial and industrial energy sectors because it is clean, abundant and suitable. It is the only viable fuel that can link the carbon-based global energy supply that we use today to a renewables-based energy supply that will have to be used in the future. Although oil, because of convenience and the lack of suitability of most other fuels, continues to dominate the transport industry, gas is fast replacing coal, oil and nuclear power in other sectors.

While gas demand has increased at an average of 2.6% per year over the last two decades, the share it takes in the energy mix has not increased. Gas use has grown primarily in power generation and heating, but oil use has grown in transport to such an extent that it has retained its relative share. But as oil supplies tighten gas must become a focus for exploration not just in the population centres. Allied to the construction of trans-continental pipeline networks, the development of better liquefaction, and the introduction of gas-in-transport (GIT) infrastructure, considerably more gas will need to be developed to help reduce oil demand.

### Forecasting

In some ways forecasting is easier for gas than for oil. Gas volumes, relative to production rates, are large, recovery factors are high, and there is less need for governments and companies to unduly promote acreage and compete for investment. Furthermore OPEC quotas do not apply to gas so there has been less incentive for OPEC members to exaggerate gas volumes.

On the other hand, problems multiply. The global gas industry is immature, only a few countries have gone past peak, and there are shorter periods of historical production that can be used to extrapolate future output. Large quantities of gas have been wasted through flaring and venting, or produced then re-injected, and large volumes of untouched unconventional gas resources exist.

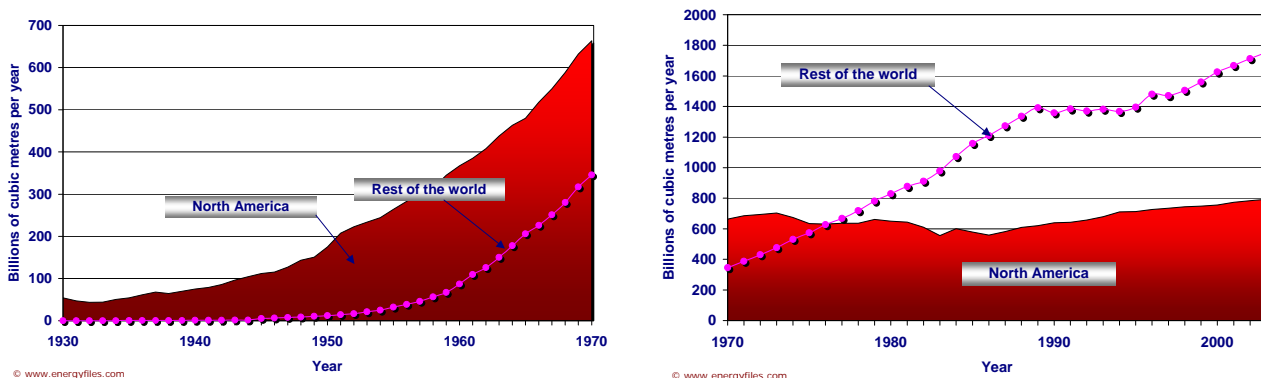


Figure 1: Historic growth in marketed gas production

### Volume estimates

Global cumulative gas production is estimated at 73 Tcm. This does not include 0.5 Tcm of coal bed methane produced in the US since 1980, approximately 15 Tcm of gas flared or vented and an unspecified amount of gas re-injected for later production. However, it does include all gas that has gone to produce liquefied natural gas. The US has produced by far the largest share.

It is estimated that “most likely” discovered but unproduced gas reserves were 159 Tcm at end 2003. The uncertainty is greatest where large reserves are relatively undeveloped, such as Russia

and Saudi Arabia, and least in countries with fewer fields or well documented production histories, such as Qatar and the Netherlands.

Global yet-to-find resources using existing technology may amount to 116 Tcm. This is a high number, much higher than the equivalent for oil. Furthermore, a significant portion of this volume is low risk gas, located in the Middle East and other moderately remote areas. The remaining higher risk gas is either located in currently producing regions, but in technologically challenging (usually deep or deepwater) reservoirs, or in remote regions, especially the Arctic.

Total global gas reserves and resources are thus estimated at 347 Tcm (equivalent in energy content terms to 2.2 Bn Bbls of oil). Russia holds by far the largest share. The US also held large quantities of gas but has already used up substantial volumes.

### Burgeoning demand

Gas output growth, both globally and in all the large producing countries, has followed a smooth path compared to oil, led by local market forces. In 2003 global production was approximately 2600 Bcm. Traditional demand is expected to grow to 4755 Bcm by 2025 - an average increase of 2.75% per year.

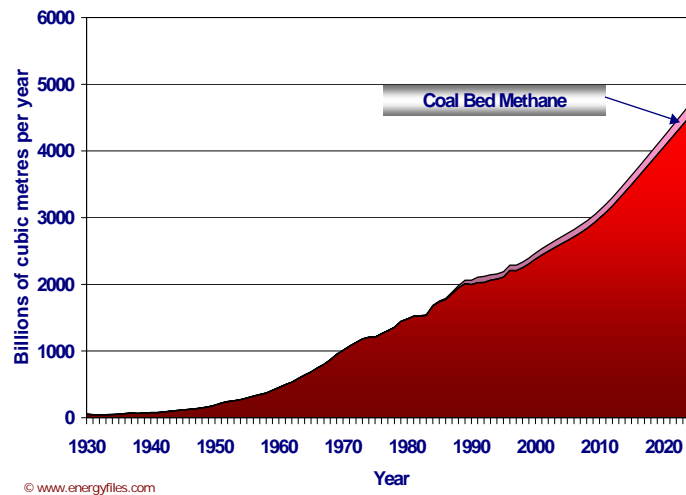


Figure 2: Gas production forecast to 2025

There are 230 independent countries, including semi-independent territories, in existence. All 88 of these countries that have or will produce gas are considered in the forecasts. In particular, although insignificant today, Bolivia, Peru, Azerbaijan, Iraq, Syria, Yemen, Angola, the 2 Congos, Equatorial Guinea, Libya, Myanmar and Vietnam may become major producers along with more obvious countries such as Russia, Iran, Algeria, Qatar and Saudi Arabia.

Global gas supplies are thus increasing as stranded (discovered) and low risk (undiscovered) volumes are progressively being developed for use in abundant new markets. But after 2015 demand, boosted by oil replacement strategies in transport, will need to be met by supplies constrained through lack of investment and a diminishing number of lower cost opportunities. These supplies can meet demand, assuming “business as usual” growth. In fact before global oil peak in the middle of the next decade there may be surplus gas capacity, which could be used to offset oil decline in the years to 2018. After this shortfalls may materialise. During these years either major investment in the gas industry, beyond that already earmarked, and/or investment in other energy sources and major conservation improvements must occur.

### Moving gas

Although most developed countries with a gas supply already have pipeline networks, a surge in the number of trunk pipelines across countries and borders is forecast. Pipes now convey 94% of

global gas (2440 Bcm per year) and this will have increased to 3275 Bcm per year by 2025, but then representing only 69% of global marketed gas. LNG supplies now come from 12 countries. Since 1980 exports have increased by 6.5% per year from 38 Bcm to over 150 Bcm, although production, as a % of total global gas production, has remained below 6%. LNG is now the world's fastest growing fuel and growth is expected to average 10% per year so that by 2025 LNG will be conveying 1240 Bcm of gas equivalent per year or 26% of the total.

Indigenous supplies are already declining in the three gas importing areas - North America, Western Europe and North Asia and around three quarters of new gas production will be traded across borders into these three regions. The international gas supply trade is set to double from around 24% in 2003 to perhaps 50% by 2025, a level where oil trade is right now. Such a market shape will favour the rapid expansion of LNG, allowing spot cargoes, short-term contracts and flexible trading alongside traditional long-term contracts.

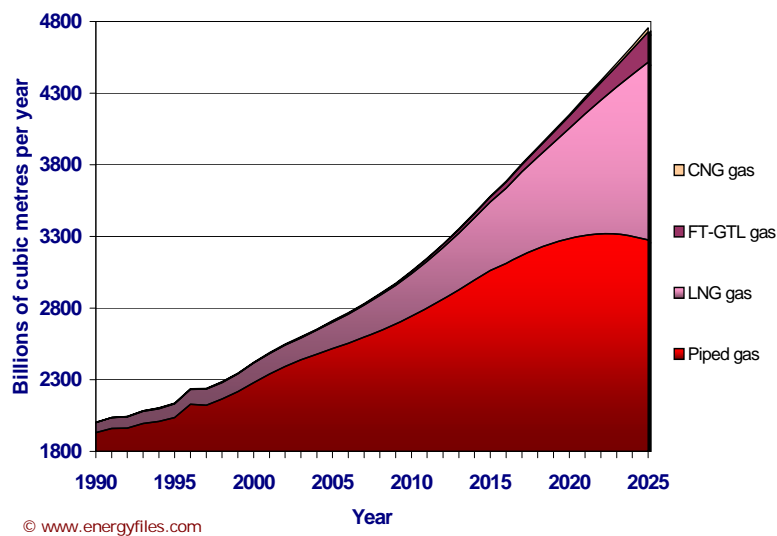


Figure 3: Gas transport system shares to 2025

Fischer-Tropsch gas to liquids (diesel) technology seems to be the most viable technique for gas to oil substitution but over the last decade development has been very slow. By 2015 it is expected that only 20 plants will be operating with a combined capacity of around 375,000 bbls per day. Assuming that new projects continue to come onstream at the same rate total capacity might reach 2.5 mm bbls per day by 2025. These plants would require dedicated gas production of around 215 Bcm of gas per year or 4.5% of the total.

Natural gas has been used to fuel vehicles (NGVs) since the 1930s but has never been able to achieve significant market penetration. With gas demand from the transport sector at only around 2 to 3% there is room for considerable increases in NGV (and electric) vehicle numbers both for environmental reasons and as oil supplies tighten.

### Competition for supply

The rate at which new gas (and other energy) can be converted to useable capacity for transport will control the extent to which prices will move in response to supply shortfalls in conventional oil. Significant contributions from renewables, nuclear power and especially coal will be required to produce electricity but gas will still be the most viable fuel. However after 2020 gas supply is unlikely to be able to meet global energy demand even assuming the required systems for automobiles have been created in time.

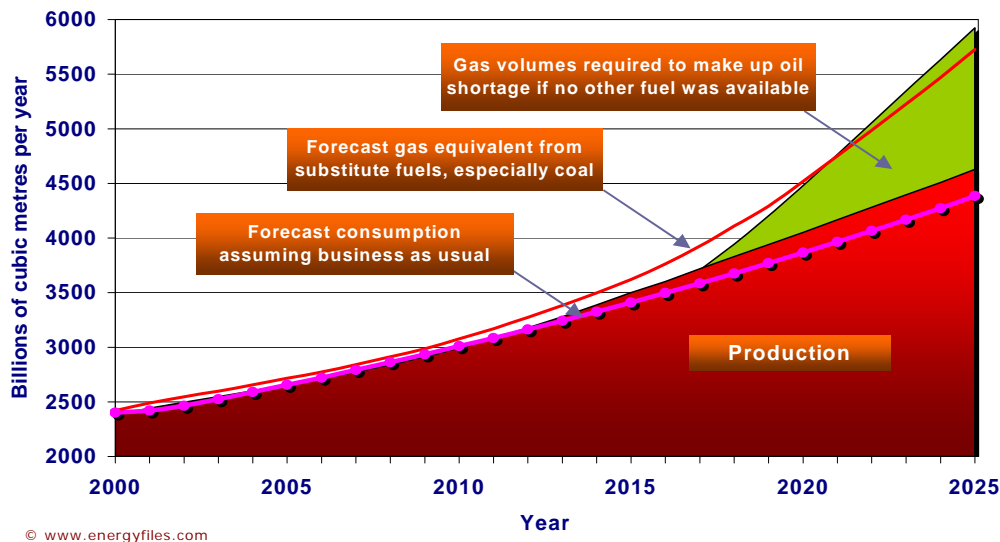


Figure 4: Gas production market shares to 2025

And beyond 2025 the gas supply situation becomes more uncertain as opportunities diminish. Supply rates from many parts of the world will be at plateau or at least flattening off so demand will be effectively constrained by investment levels in just a few countries. A plateau of around 5150 Bcm of gas per year will be reached in 2032 controlled by geological influences rather than infrastructural ones although the level and the year in which it begins are dependent on the global situation in preceding years.

Global competition for gas has not yet begun, but will do so very soon, at first due to constraints on the availability of infrastructure. As gas continues to replace oil, Western Europe will compete for Norwegian, Russian, North African and Middle Eastern gas supplies. Major energy users in Western Europe with impending shortfalls should negotiate long-term piped and LNG gas supply contracts well before 2016 (and probably by 2007) to ensure adequate capacity. Eastern Europe is better placed being first on the supply chain from Russia.

The US has seen the need to substantially grow LNG shipments and will be competing with Western Europe, Japan and China for Russian, Asian, Australasian, North African and Middle Eastern supplies. There is already competition between China and Japan for Russian gas.

Apart from the oil producers (including Russia, Venezuela and those in the Middle East and West Africa) and populous countries with indigenous or nearby gas supplies (such as Pakistan and Thailand) much of the resource-poor developing world will be unable to afford fossil fuels after the middle of the next decade to support even minimal economic growth.

## References

Smith, Michael R., 2004, *The World Gas Supply Report 2004-2025*, published by Douglas-Westwood Ltd. pp293.

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