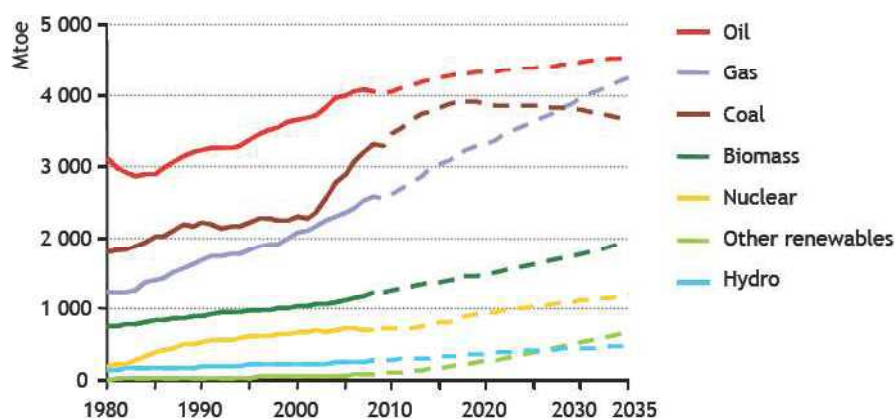


IEA special report explores potential for 'golden age' of natural gas on 6 June 2011. For more information, please visit <http://www.worldenergyoutlook.org> Report contains a lot of information, composed of 131 pages.

Primary demand

In the GAS Scenario, global primary energy demand is projected to rise from around 12 300 million tonnes of oil equivalent (Mtoe) in 2008 to 16 800 Mtoe in 2035 – an increase of over 35%. This is slightly higher than in the New Policies Scenario, largely because of the assumed lower price of gas. The average rate of growth in energy demand slows during the *Outlook* period, from 1.5% per year in the period 2008–2020 to 0.9% per year in 2020–2035. The demand for all energy sources increases over the *Outlook* period. Fossil fuels (oil, coal and natural gas) account for more than half of the increase and remain the dominant energy sources in 2035 (Figure 1.1). However, the share of fossil fuels in the overall primary energy mix decreases from 81% in 2008 to just over 74% in 2035, marginally higher than in the New Policies Scenario. The rest of the increase in global energy demand through to 2035 is accounted for by renewables and nuclear power.

Figure 1.1 ▶ World primary energy demand by fuel in the GAS Scenario



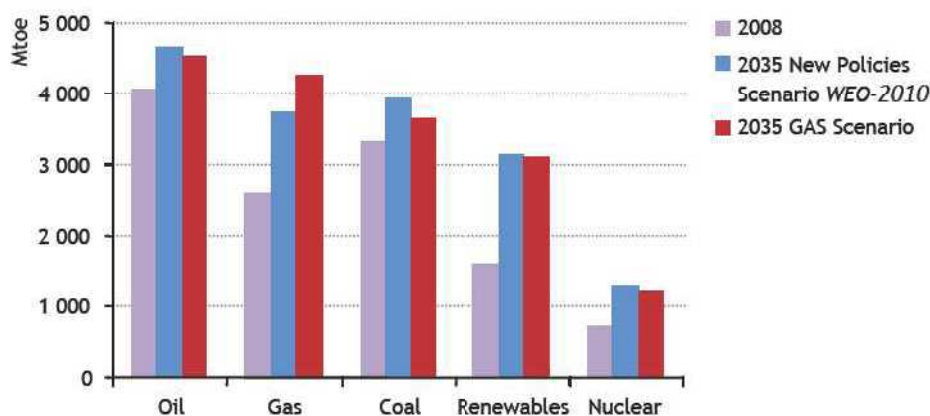
In the GAS Scenario, global primary natural gas demand is around 600 bcm higher than in the New Policies Scenario in 2035. It increases from 3.1 tcm in 2008 to 5.1 tcm in 2035 – an increase of 62% – the average rate of increase in gas demand being nearly 2% per year. Unsurprisingly, natural gas sees the strongest demand growth of all energy sources in absolute terms in the GAS Scenario.

Natural gas increases from 21% of the world's fuel mix in 2008 to 25% in 2035, compared with 22% in the New Policies Scenario. The combined effect of a strong increase in natural gas demand throughout the *Outlook* period and a decline in global coal demand from around 2020 onwards results in global demand for natural gas overtaking coal before 2030, to become the second-largest fuel in the primary energy mix. The GAS Scenario also sees demand for natural gas narrowing significantly the gap with oil by the end of the *Outlook* period.

While oil continues to be the dominant fuel in the primary energy mix (Figure 1.2), with demand increasing from 4 060 Mtoe in 2008 (85 million barrels per day [mb/d]) to just under 4 550 Mtoe in 2035 (97 mb/d), its share of the mix drops from 33% in 2008 to 27% in 2035. High prices promote further switching away from oil in the industrial sector and opportunities emerge to substitute other fuels for oil products in road-transport.

Primary coal demand increases from 3 315 Mtoe in 2008 (4 736 million tonnes of coal equivalent [Mtce]) to 3 670 Mtoe in 2035 (5 240 Mtce), a rise of 11% in the GAS Scenario. It peaks around 2018 and then declines by nearly 250 Mtoe (6%) over the remainder of the *Outlook* period. The decline between 2018 and 2035 is comparable with the annual coal demand of OECD Pacific in 2008. The projected decline in coal demand in the GAS Scenario contrasts with a levelling-off of demand from around 2020 in the New Policies Scenario.

Figure 1.2 ▸ World primary energy demand by fuel and scenario



The share of nuclear power in global primary energy supply increases from 6% in 2008 to 7% in 2035 – with 330 GW of new generating capacity added – but it is below the 8% projected in the New Policies Scenario. This is partly in response to the imposed assumption of a 10% fall in nuclear, but also because lower prices mean that gas competes more effectively with nuclear power for power generation. Hydro, biomass and other renewables all see their share of the energy mix increase in the GAS Scenario, the increase being about the same as in the New Policies Scenario. The absolute level of renewable energy supply is relatively unchanged from the New Policies Scenario. This is because we assume that government support for renewables is kept in place in order to meet targets, despite the lower gas prices.

The combination of more competitive gas prices, policy changes in China to 2015, a more restricted outlook for nuclear power and increased future uptake of NGVs results in a significant increase in natural gas demand over the *Outlook* period. The majority of the increase in primary natural gas demand relative to the New Policies Scenario comes at the expense of coal and oil (Table 1.2). A much smaller share comes from replacing nuclear. Renewables are relatively unchanged, in response to our assumptions.

Energy demand is expected to continue to grow much more quickly in non-OECD countries. Their primary energy demand increases by almost 65% from 2008 to 2035 in the GAS Scenario. Non-OECD countries account for over 90% of all energy demand growth globally and see their share of global energy use increase from 53% in 2008 to 64% in 2035. Faster rates of economic and population growth, urbanisation and industrial production all play a part in stimulating stronger energy demand growth than in the OECD. Despite OECD consumption increasing by around 3% over the *Outlook* period, its contribution to global

primary energy demand continues its decline from 55% in 1981 to 44% in 2008, and then to just 33% in 2035.⁵

Table 1.2 ► World primary energy demand by fuel and scenario

	2008		GAS Scenario		New Policies Scenario <i>WEO-2010</i>	
	Demand (Mtoe)	Share in energy mix	2035 Demand (Mtoe)	2035 Share in energy mix	2035 Demand (Mtoe)	2035 Share in energy mix
Coal	3 315	27%	3 666	22%	3 934	23%
Oil	4 059	33%	4 543	27%	4 662	28%
Gas	2 596	21%	4 244	25%	3 748	22%
Nuclear	712	6%	1 196	7%	1 273	8%
Hydro	276	2%	477	3%	476	3%
Biomass	1 225	10%	1 944	12%	1 957	12%
Other renewables	89	1%	697	4%	699	4%
Total	12 271		16 765		16 748	

Regional demand trends

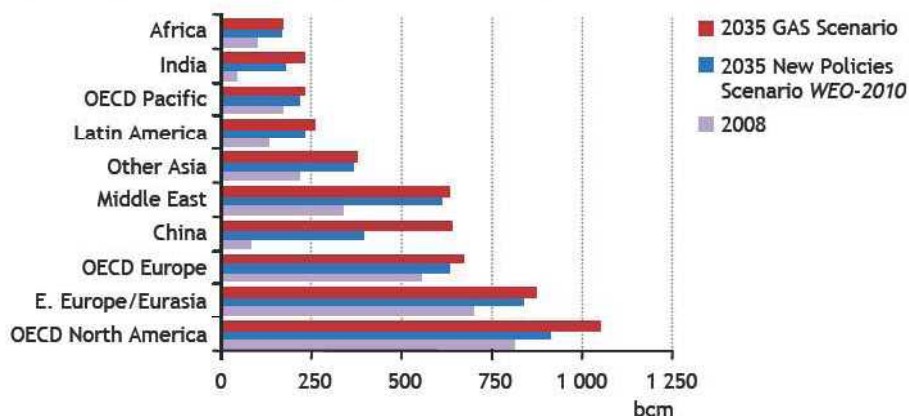
In the GAS Scenario, demand for natural gas grows in all *WEO* regions⁶ over the *Outlook* period. In the OECD, while demand for natural gas increases in absolute terms over 2008 to 2035, demand for oil and coal declines significantly. China accounts for nearly 30% of world gas demand growth. In volumetric terms, gas demand in China increases dramatically, from 85 bcm in 2008 to 635 bcm in 2035 (Figure 1.3). Overwhelmingly, this increase comes at the expense of coal. Overall, China's total primary energy demand in 2035 is slightly lower than in the New Policies Scenario. This is mainly because there is a shift from coal to gas, which can be transformed more efficiently into electricity. Gas demand in power generation in China increases relative to the New Policies Scenario, but the increase is not large in absolute terms. Gas demand increases much more in industry, which sees average annual growth of around 9% between 2008 and 2035, and in the buildings sector, where demand reaches 170 bcm, more than 80% higher than in the New Policies Scenario in 2035.

India already experiences very strong growth in natural gas demand in the New Policies Scenario, but from a low base. The GAS Scenario sees demand in 2035 boosted by around a further 57 bcm, mainly as a result of an increase in gas use in power generation and to meet transport demand. In response, oil demand in the transport sector in India falls by around 0.6 mb/d in 2035 compared with the New Policies Scenario. India's total primary natural gas demand is still only around one-third that of China by the end of the *Outlook* period.

⁵ The OECD and non-OECD shares of global energy demand do not sum to world energy demand as they do not include international marine and aviation bunkers.

⁶ Definitions of the *WEO* regions can be found online at www.worldenergyoutlook.org/model.asp

Figure 1.3 ▶ Primary natural gas demand by region and scenario



In the GAS Scenario, the Middle East sees an increase in gas demand of around 300 bcm, to reach over 600 bcm by 2035. Much of the overall increase in gas demand is a result of rapid growth in electricity demand, and increased industrial use. Demand in the GAS Scenario is around 25 bcm higher than in the New Policies Scenario, more than 60% of this increase is demand from gas-to-liquids (GTL) plants.

In Latin America, the GAS Scenario sees significantly faster gas demand growth. Brazil is the main driver of regional gas demand, growing from 25 bcm in 2008 to 98 bcm in 2035 and its share of total demand in Latin America rising from 19% to 38%. Demand growth is driven primarily by industry and power generation, including gas use for power peaking capacity in support of renewables.

Within the OECD, the United States sees the largest change in natural gas demand *vis-à-vis* the New Policies Scenario. At nearly 790 bcm in 2035, gas demand is around 18% higher. This increase is driven by the power generation and transport sectors, causing coal demand to drop by around 9% and oil demand by around 6% in 2035, compared with the New Policies Scenario. In the power sector, lower gas prices prompt increased electricity demand and therefore higher capacity additions, but it also means that gas-fired generating capacity substitutes for the most inefficient coal-fired generating capacity. In the GAS Scenario, the share of coal in the electricity generation mix declines from 49% in 2008 to 30% in 2035, and gas increases from 21% in 2008 to 27% in 2035. In the transport sector, the increase in NGVs is driven initially by commercial fleet vehicles, such as buses.

Gas demand in OECD Europe reaches nearly 670 bcm in 2035 in the GAS Scenario (Table 1.3). Power generation accounts for about three-quarters of the additional gas demand over the *Outlook* period. In Japan, demand for gas in power generation is around 10% higher in 2035 than in the New Policies Scenario. Most of this change occurs in the early part of the *Outlook* period, where demand for liquefied natural gas (LNG) increases to offset lower growth in nuclear power.

Table 1.3 ▶ Primary natural gas demand by region in the GAS Scenario (bcm)

	2008	2015	2020	2025	2030	2035	2008-2035*	Change vs. NPS 2035**
OECD	1 541	1 615	1 691	1 773	1 865	1 950	0.9%	192
North America	815	841	872	924	986	1 052	0.9%	138
<i>United States</i>	662	661	668	700	741	786	0.6%	122
Europe	555	574	608	636	653	667	0.7%	38
Pacific	170	200	210	213	226	231	1.1%	15
<i>Japan</i>	100	118	122	123	127	127	0.9%	10
Non-OECD	1 608	2 070	2 328	2 611	2 912	3 182	2.6%	405
E. Europe / Eurasia	701	755	786	824	857	876	0.8%	38
<i>Russia</i>	453	474	487	504	522	528	0.6%	25
Asia	341	576	715	864	1 049	1 244	4.9%	309
<i>China</i>	85	247	335	430	535	634	7.7%	239
<i>India</i>	42	81	104	134	176	234	6.5%	57
Middle East	335	428	470	536	592	632	2.4%	23
Africa	100	139	154	164	170	173	2.1%	9
Latin America	131	172	203	224	245	258	2.5%	26
<i>Brazil</i>	25	48	66	76	88	98	5.1%	21
World	3 149	3 685	4 019	4 384	4 778	5 132	1.8%	597
<i>European Union</i>	536	553	587	609	621	636	0.6%	38

*Compound average annual growth rate.

**NPS is New Policies Scenario.

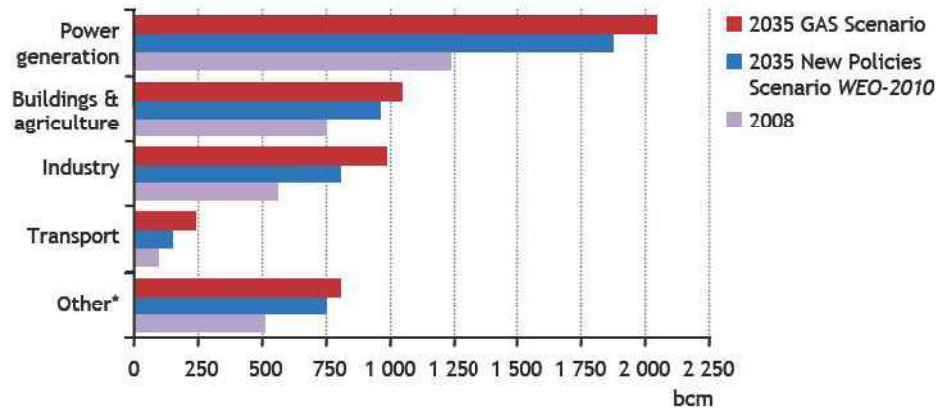
Sectoral demand trends

In the GAS Scenario, a broad increase in natural gas demand is observed across sectors, reflecting its flexibility as an energy source. The largest sector for gas demand continues to be power generation and, along with the industry sector, it experiences the biggest increase compared to the New Policies Scenario in 2035 (Figure 1.4).

In the GAS Scenario, global demand for energy as an input to power generation in 2035 is slightly lower than in the New Policies Scenario. This is despite the fact that electricity consumption in 2035 is around 1% higher than in the New Policies Scenario, in response to lower gas prices. The difference is explained by the much higher average efficiency of gas conversion in power generation.

The gas input to power generation exceeds 2 tcm by the end of the *Outlook* period. This growth reinforces the position of the power sector as by far the largest source of natural gas demand, the sector's 39% share of global natural gas demand in 2008 rises to 40% by 2035 in the GAS Scenario (compared with 41% in the New Policies Scenario).

Figure 1.4 ► World primary natural gas demand by sector and scenario



* Includes other energy sector and non-energy use. Other energy sector includes energy consumed in oil and gas production, gas-to-liquids transformation and distribution losses. Non-energy use includes inputs to petrochemicals.

In the GAS Scenario, the share of natural gas in electricity generation increases from 21% to 24% in 2035. This increase comes mainly at the expense of coal, as well as nuclear power, where policy decisions and less competitive prices slow down growth in this scenario. The share of oil in power generation, already small, continues to decline. Assumed support policies help ensure that the growing use of biomass and other renewables is not substantially eroded by natural gas use: there is scope for their co-existence in the power generation mix, natural gas being an option to meet peaking and variability requirements. However, with lower gas prices in this scenario, resolute government commitment to undiminished support for renewables will be required to maintain their assumed role in the energy mix. The way natural gas demand in the power generation sector responds to economic, environmental and other uncertainties, all of which will impact its desirability relative to other fuels, is elaborated in Section 3.

Total final consumption of natural gas in the GAS Scenario is projected to reach 2.5 tcm by 2035, 17% higher than in the New Policies Scenario. Demand in the buildings sector – the largest end-use sector – reaches over 1 tcm by 2035. In the OECD, further demand for gas to provide space and water heating is relatively low, but in many non-OECD countries the remaining potential is large. Demand for gas in the buildings sector more than doubles in non-OECD countries over the *Outlook* period and is nearly 80 bcm higher than the New Policies Scenario in 2035. The massive scale of construction in China drives a particularly high growth rate in gas use in the buildings sector. In comparison, growth in the OECD is less than 10% over the period and is concentrated in Europe.

In the GAS Scenario, natural gas demand in the industry sector increases by around 75% over the *Outlook* period, to reach nearly 1 tcm, 185 bcm more than the New Policies Scenario. Again, OECD countries see relatively little change in gas demand in industry over 2008 to 2035. Those countries that experience increased demand in the first half of the *Outlook* period, such as the United States, typically see this reversed later as demand declines in gas-intensive industries. In the GAS Scenario, non-OECD industrial gas demand