Global Energy Outlook: Issues and Challenges

Background Paper by the International Energy Agency for the 10th International Energy Forum, 22-24 April 2006

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Summary

- For all the current talk about the imminent end to the petroleum age, hydrocarbons will continue to play the leading role in meeting the world's growing hunger for energy for at least the next quarter of a century and probably well beyond. If governments stick with current policies – as assumed in the Reference Scenario of the IEA's *World Energy Outlook 2005* – the world's energy needs would be 25% higher in 2015 and more than 50% higher in 2030 than today. Oil and gas combined would meet two-thirds of that increase.

- These projections should alert policymakers to three major challenges. First, the sharply increased dependence of consuming regions on imports from a small number of countries, which would exacerbate worries about the security of energy supply and the economic threat posed by higher energy prices. Second, rising climate-destabilising carbon-dioxide emissions, which call into question the long-term sustainability of the global energy system. And third, the energy poverty endured by many of the world's poorest people, who will still lack access to modern energy services. In no sense can the energy future depicted in the Reference Scenario be considered sustainable or acceptable.

- Rising global oil demand will have to be met increasingly by a small number of countries with large reserves, primarily the big producers in the Middle East and North Africa. MENA's share of world oil production will grow from 35% now to 37% in 2015 and 44% in 2030 in the Reference Scenario. Together with Russia, MENA is also expected to play an increasingly important role in meeting the growth in gas use in importing regions. Russia will remain the world's largest gas exporter.

- These projections assume that resource-rich countries are willing to develop new production capacities to meet the projected call on their oil and gas at the prices assumed. MENA countries alone will need to invest over $1 billion and Russia about $700 billion over 2004-2030. Globally, the refining industry will need to invest close to $500 billion. Whether all the required investment is actually forthcoming is a critical uncertainty. Current under-investment in gas-supply infrastructure in Russia and Central Asia is a major concern for the IEA as it could lead to a supply crunch in Europe in the next few years.

- In two other scenarios, global oil demand and the volume of MENA oil and gas exports continue to grow. In a Deferred Investment Scenario, much lower MENA oil production drives up the international price of oil and, with it, the prices of gas and coal. Higher energy prices, together with slower economic growth, choke off energy demand in all regions and reduce demand for MENA oil and gas compared with the Reference Scenario, the detriment economically to both producing and consuming countries. MENA exports, nonetheless, continue to grow. Current oil market instability bears added testimony to the vital importance of adequate upstream and downstream investment.

- More vigorous government policies in consuming countries could, nonetheless, steer the world onto a markedly different energy path from those envisioned in the Reference and Deferred Investment Scenarios. An Alternative Policy Scenario demonstrates that if governments around the world were to implement a range of new policies currently being considered aimed at addressing environmental and energy-security concerns, fossil-fuel demand and carbon-dioxide emissions would be significantly lower than in the Reference Scenario. But global energy demand in 2030 would still be well over a third higher than today and the volume of MENA hydrocarbon exports would still grow significantly. It is clear that achieving a truly sustainable energy system – and reducing dependence on imported oil and gas – will depend major technological breakthroughs that radically alter how we produce and use energy, as well as on far more radical policy action than currently envisaged.

- There is a strong case for improving oil and gas market transparency, for establishing more effective mechanisms for exchanging information between producers and consumers, and for deepening the dialogue between them. Concerns among consuming countries about security of supply are matched by those among producing countries about security of demand. Consumer and producer governments need to work together to reconcile their interests and achieve mutually beneficial outcomes.

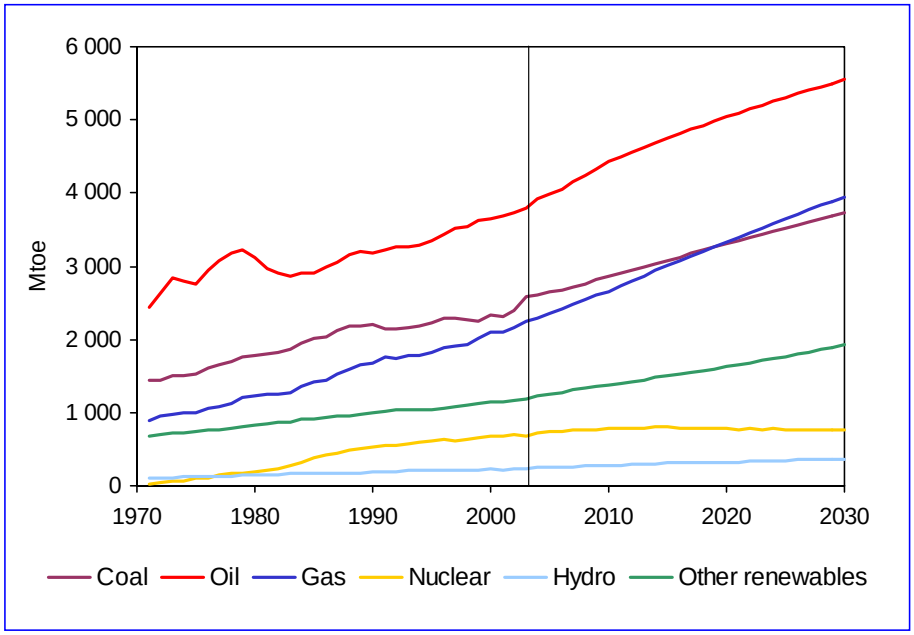
This background paper sets out the IEA's vision of how the global energy market could evolve in the medium to long term and describes the main issues, uncertainties and policy challenges surrounding future energy trends. The results of three scenarios, recently presented in the World Energy Outlook 2005, are summarised here: a Reference Scenario, which assumes no new government actions; a Deferred Investment Scenario, which looks at the impact of a shortfall in upstream investment in the Middle East and North Africa; and an Alternative Policy Scenario, which analyses the effect of a range of government policies to address environmental and energy-security concerns.

The Global Energy Outlook

For all the current talk about the imminent end to the petroleum age, hydrocarbons will continue to play the leading role in meeting the world's growing hunger for energy for at least the next quarter of a century, and probably well beyond. In any plausible scenario, global consumption of both oil and gas – as well as energy in aggregate – continue to rise. The supply of oil and gas from the Middle East and North Africa also increase. In each case, the amount of climate-destabilising carbon-dioxide emitted in the combustion of fossil fuels also grows.

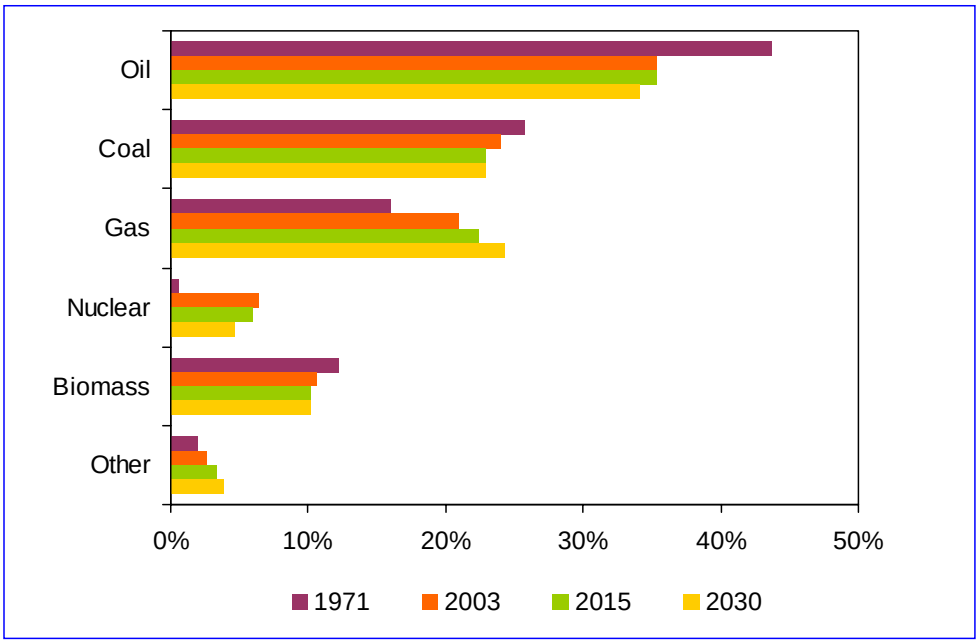
In the Reference Scenario of the IEA's *World Energy Outlook* 2005, which assumes that governments stick with current policies, the world's energy needs would be 25% higher in 2015 and more than 50% higher in 2030 than today, an average annual growth rate of 1.6%. Global demand is projected to grow from 10.7 billion tonnes of oil equivalent today to 13.4 billion toe in 2015 and 16.3 billion toe in 2030. More than two-thirds of this increase will come from the developing countries, where economic and population growth is highest.

Figure 1: **World Primary Energy Demand by Fuel in the Reference Scenario**



Fossil fuels continue to dominate energy supplies, meeting more than 80% of the projected increase in primary energy demand in this scenario. Oil remains the single largest fuel throughout the projection period (Figure 1). Its share will nonetheless fall marginally, from 35% in 2003 to 34% in 2030 (Figure 2). Natural gas demand grows faster, driven mainly by power generation, overtaking coal as the world's second-largest primary energy source before 2015. The shares of both coal and nuclear power in world primary demand fall a little, while that of hydropower remains broadly constant. The share of biomass declines slightly, as it is replaced with modern commercial fuels. The share of other renewables, including geothermal, solar, wind, tidal and wave energy, will grow more than that of any other energy source, but still reaches only 2% in 2030.

Figure 2: **Fuel Shares in World Primary Energy Demand in the Reference Scenario**



After registering strong growth of 2% in 2003, world oil consumption in 2004 increased even more quickly, by 3.6%. This is the fastest rate of growth since 1978. China, which saw a jump of 16% or nearly 0.9 mb/d in its oil use in 2004, accounted for 30% of the global demand increase. This surge came despite record oil prices. Prices peaked at more than $70 for WTI in late summer – a record in nominal terms – and, after a temporary easing of prices towards the end of the year, rebounded again in early 2006. However, adjusted for inflation, prices are still below the levels of the 1970s. The surge in prices initially did little to cool demand, but there are clear signs that demand growth may now be starting to taper off, especially in Asia and North America. Although the world economy has coped well so far with the run-up in oil prices, the longer they remain high and the further they increase, the greater the threat will be to economic growth and prosperity worldwide.[1]

Assuming prices fall back in the next few years, oil demand is projected to continue to grow steadily over the projection period, with developing countries – particularly China, India and Africa as a whole – registering the fastest rates of growth (Table 1). Oil use grows by 1.4% per year, from 82 mb/d in 2004 to 99 mb/d in 2015 and 115 mb/d in 2030. Two-thirds of the total increase in oil use will come from the

[1] The impact of high energy prices on energy demand and the macroeconomy will be analysed in detail in the *World Energy Outlook 2006*, to be released in November.

transport sector, where oil will remain the main fuel. The transport sector will account for 50% of global primary oil consumption in 2015 and 54% in 2030, compared with 48% now. Transport will absorb two-thirds of the increase in total oil use. Almost all the energy currently used for transport purposes is in the form of oil products. The lack of substitutes for oil-based automotive fuels will make oil demand increasingly rigid.

Table 1: **World Oil Demand in the Reference Scenario** (million barrels per day)

	2004	2015	2030	2004-2030*
OECD	**47.6**	**52.2**	**55.1**	**0.6%**
OECD North America	24.9	28.1	30.6	0.8%
OECD Europe	14.5	15.3	15.7	0.3%
OECD Pacific	8.3	8.7	8.8	0.3%
Transition economies	**4.4**	**5.3**	**6.2**	**1.3%**
Russia	2.6	3.1	3.5	1.2%
Developing countries	**27.0**	**38.5**	**50.9**	**2.5%**
China	6.2	10.0	13.1	2.9%
India	2.6	3.8	5.2	2.8%
Other Asia	5.4	7.5	9.9	2.3%
Latin America	4.7	6.0	7.5	1.9%
Africa	2.6	3.9	5.7	3.0%
Middle East	5.4	7.3	9.4	2.2%
Miscellaneous**	3.0	3.2	3.3	0.3%
World	**82.1**	**99.1**	**115.4**	**1.3%**

*Average annual growth rate. ** Includes bunkers and stock changes.

Non-transport demand for oil will increase, but much more slowly than that for transport. Oil will remain a marginal fuel in power generation, with its share declining in every region. Industrial, commercial and residential demand for oil is projected to increase moderately, with all of the growth coming from non-OECD countries. Oil products will remain the main source of modern commercial energy for cooking and heating in developing countries, especially in rural areas. The use of oil in non-transport sectors in OECD countries will decline markedly.

Primary demand for natural gas will grow on average by 2.1% in 2003-2030. Demand will increase by 34% between 2003 and 2015, reaching 3 650 billion cubic metres. By 2030, it will reach 4 789 bcm, an increase over three-quarters of current levels. The share of gas in world energy demand will rise from 21% in 2003 to 22% in 2015 and 24% in 2030 – mostly at the expense of coal and nuclear energy. Power generation will account for most of the increase in gas demand over the projection period because, in many parts of the world, gas is expected to be the preferred fuel in new power stations for economic and environmental reasons. Stronger government support for nuclear power than assumed here – an option currently under discussion in many countries – could significantly dampen the growth in the use of gas for power generation. A small but increasing share of gas demand will come from gas-to-liquids plants, which convert natural gas into distillate and other oil products, and from hydrogen plants to supply fuel cells. Gas demand will grow fastest in developing countries (Table 2).

Demand for coal is projected to rise from almost 5 200 million tonnes (Mt) in 2003 to almost 7 300 Mt in 2030, an average annual rate of increase of 1.4%. Its share in world primary demand will still fall a little, from 24% in 2003 to 23% in 2030. China and India, which both have large coal resources, will together account for about two-thirds of the increase in world coal demand. Power generation will remain the main driver of world coal demand, though coal will continue to lose market share in power generation in all OECD regions and in some developing regions. The industrial, residential and commercial sectors in non-OECD regions will burn more coal, more than offsetting a drop in final use in the OECD.

Table 2: **World Natural Gas Demand by Region in the Reference Scenario** (bcm)

	2004	2015	2030	2004-2030*
OECD	**1 449**	**1 761**	**2 061**	**1.4%**
OECD North America	771	919	1 039	1.2%
OECD Pacific	142	198	244	2.1%
OECD Europe	535	644	778	1.5%
Transition Economies	**656**	**762**	**925**	**1.3%**
Russia	427	492	591	1.3%
Developing Countries	**686**	**1 132**	**1 803**	**3.8%**
China	47	81	152	4.6%
India	30	55	98	4.6%
Other Asia	172	260	387	3.2%
Latin America	118	179	318	3.9%
Africa	77	136	232	*4.3%*
Middle East	241	420	615	3.7%
World	**2 790**	**3 654**	**4 789**	**2.1%**

* Average annual growth rate.

The share of nuclear power in global primary energy demand will decline over the projection period. Few new reactors are expected to be built and several will be retired. As a result, nuclear production is projected to peak around 2015 and then decline gradually. Its share of world primary demand will remain flat, at about 6%, through 2015 and then fall to less than 5% by 2030. However, these projections remain very uncertain. Shifts in government policies and public attitudes towards nuclear power could mean that this energy source plays a much more important role than projected here. World hydropower production is projected to grow by an average 1.8% a year through 2030 and its share of primary demand will remain broadly constant at 2%. The developing countries will account for over three-quarters of the increase in hydropower production.

The role of biomass and waste, much of which is used in traditional ways in developing countries, will decline slightly over the projection period. Their share of world primary energy demand will fall from 11% in 2003 to 10% in 2030, as they are replaced by modern commercial fuels. In absolute terms, the consumption of traditional biomass in developing countries will continue to grow. Traditional fuels will remain the primary source of energy for most households in the world's poorest countries (Box 1). Other renewables – a group that includes geothermal, solar, wind, tidal and wave energy – will grow faster than any other energy source, at an average rate of 6.2% per year over the projection period. But they will still make only a small contribution to meeting global energy demand in 2030, because they start from a very low base. Their share in primary demand will grow from 0.5% in 2003 to 1% in 2015 and 1.7% in 2030. Most of the increase in the use of renewables will occur in the power sector in OECD countries.

Box 1: **The Challenge of Energy Poverty**

Energy is a prerequisite to economic development. Energy services enable basic human needs, such as food and shelter, to be met. They also contribute to social development by improving education and public health. During the early stages of development, the absolute amount of energy used per capita and the share of modern energy services are key contributors to human development.

Many households in the world's poorest countries continue to lack access to modern energy service. Around 2.4 billion people – about 39% of the world's population – still rely almost entirely on traditional fuels for cooking and heating. Access to electricity is particularly crucial to human development. Electricity is, in practice, indispensable for certain activities, such as lighting, refrigeration and the running of household appliances, and cannot easily be replaced by other forms of energy. As a result, access to and usage of electricity are strongly correlated with measures of human

development. Today, almost 1.6 billion people in developing countries do not have access to electricity in their homes, representing a little over one-third of the world's population. Most of the electricity-deprived are in Asia and sub-Saharan Africa.

The IEA's Energy Development Index provides a composite measure of the evolution of energy use in developing countries and of their progression in the use of modern energy services. In the Reference Scenario, the standing of all regions on that index increases between now and 2030. Yet only a few Middle East and Latin American countries will have reached the stage of energy development that OECD countries had attained three decades ago. Most of Africa and South Asia will remain far behind. The share of commercial energy in developing countries as a whole is projected to rise from 80% to 88%, but the number of people relying on traditional fuels will, nonetheless, grow to over 2.6 billion in 2030. Despite rising electrification rates, the total *number* of people without electricity will fall only slightly, to just under 1.4 billion in 2030. In fact, two billion more people will gain access to electricity, but this will be largely offset by rising world population.

The UN Millennium Development Goals include halving the proportion of the world's people living on less than $1 a day by 2015. In the Reference Scenario, the number of people without electricity in 2015 will be only slightly smaller than in 2000. It is very unlikely that the UN poverty-reduction target will be achieved unless access to electricity can be provided to another half-a-billion of the people we expect will still lack it. This would cost about $200 billion. Meeting the target also implies a need to extend the use of modern household fuels to 700 million more people by 2015.

Governments of rich and poor countries alike need to act decisively to accelerate the transition to modern fuels and to break the viscous circle of energy poverty and human under-development in the world's poorest countries. This will entail improving the availability and affordability of commercial energy, particularly in rural areas. The rich industrialised countries have clear long-term economic and security interests in helping developing countries along the energy-development path.

Global energy intensity, measured as total primary energy use per unit of gross domestic product, is projected to fall by 1.6% per year over 2003-2030. Intensity will fall most quickly in the non-OECD regions, largely because of improved energy efficiency in power generation and end-uses, but also because of structural economic changes away from heavy industry towards lighter industry and services. The transition economies, in particular, will become much less energy-intensive as more energy-efficient technologies are introduced, wasteful energy practices are tackled and energy markets are reformed.

Oil Supply Outlook

Global Trends in Crude Oil Production and Trade

The world's economically exploitable oil resources are adequate to meet the projected growth in energy demand in the Reference Scenario. Global proven oil reserves today exceed the cumulative projected production between 2004 and 2030, but additional reserves will need to be moved form the possible and probable categories into the proven category in order to avoid a peak in production before the end of the projection period. Exploration will undoubtedly be stepped up to ensure this happens. Nonetheless, there will be a pronounced shift in the geographical breakdown of sources of oil and gas production over the projection period, in response to a combination of cost, geopolitical and technical factors. Almost all the net increase in production will occur in non-OECD countries, mainly in the developing world.

World oil supply in the Reference Scenario is projected to grow from 82 mb/d in 2004 to 99 mb/d in 2015 and 115 mb/d in 2030 (Table 3). Non-OPEC countries contribute most of the increase in global production over the rest of the current decade. High oil prices have started to stimulate increased development of reserves in those countries in recent years. Production is expected to continue to grow particularly strongly in transition economies, West Africa and Latin America. The output of the transition economies, which has soared in recent years, thanks to rapid growth in Russia, will continue to rise, with Caspian countries making a larger contribution. It will reach 15 mb/d in 2015, compared to 11 mb/d in 2004.

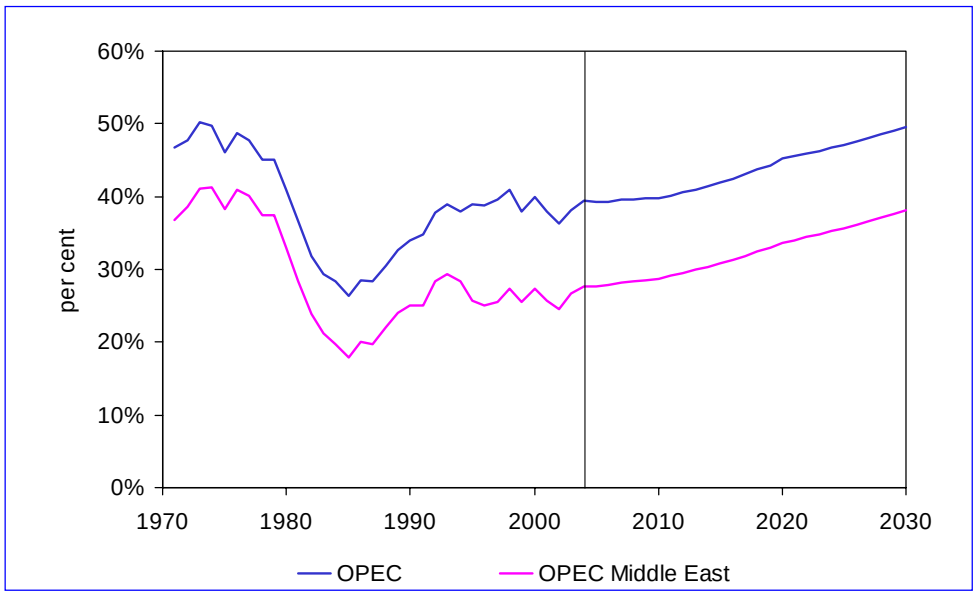
In the longer term, oil production in OPEC countries, especially in the Middle East, is expected to increase more rapidly than in other regions – particularly in the second half of the projection period – because their resources are much larger and their production costs are generally lower. In the near term, the cartel's share, which currently stands at 36%, will remain roughly stable owing to rapid production increases in several non-OPEC regions (Figure 3). As prices return to a level closer to the average of the last two decades, incentives to raise output in non-OPEC regions will diminish, increasing the call on oil from OPEC producers. The second half of the projection period will see more rapid growth in OPEC's market share. OPEC's market share is projected to reach 42% in 2015 and 50% in 2030, slightly above its historical peak in 1973.

Table 3: **World Oil Production in the Reference Scenario** (million of barrels per day)

	2004	2015	2030	2004-2030*
Non-OPEC Crude & NGLs	**46.7**	**50.5**	**46.1**	**0.0**
OECD total	**20.2**	**17.7**	**13.5**	**-1.5**
North America	13.6	13.5	10.8	-0.9
Europe	6.0	3.8	2.3	-3.7
Pacific	0.6	0.4	0.4	-1.4
Transition economies	**11.4**	**15.1**	**16.4**	**1.4**
Russia	9.2	10.8	11.1	0.7
Developing countries	**15.2**	**17.7**	**16.3**	**0.3**
China	3.5	3.2	2.4	-1.5
India	0.8	0.8	0.6	-1.2
Other Asia	1.9	1.9	1.3	-1.7
Latin America	3.8	5.0	6.1	1.8
Non-OPEC Africa	3.3	5.1	4.7	1.4
Non-OPEC Middle East	1.9	1.6	1.4	-1.3
OPEC Crude & NGLs	**32.3**	**41.6**	**57.2**	**2.2**
OPEC Middle East	22.8	30.6	44.0	2.6
Other OPEC	9.6	11.0	13.2	1.3
Non-conventional oil	**2.2**	**5.1**	**10.2**	**6.1**
Miscellaneous	0.9	1.9	1.9	2.9
World	**82.1**	**99.1**	**115.4**	**1.3**

*Average annual growth rate. ** Includes oil sands, biofuels and gas-to-liquids production.

Figure 3: **OPEC Share of World Oil Supply in the Reference Scenario**



Global oil production is not expected to peak before 2030, although output in most regions will already be in decline by then (Box 2). OPEC's market share would be lower if its members' policies have the effect of limiting production and driving up prices, thereby stimulating non-OPEC production of conventional and non-conventional oil, and encouraging alternative energy technologies.

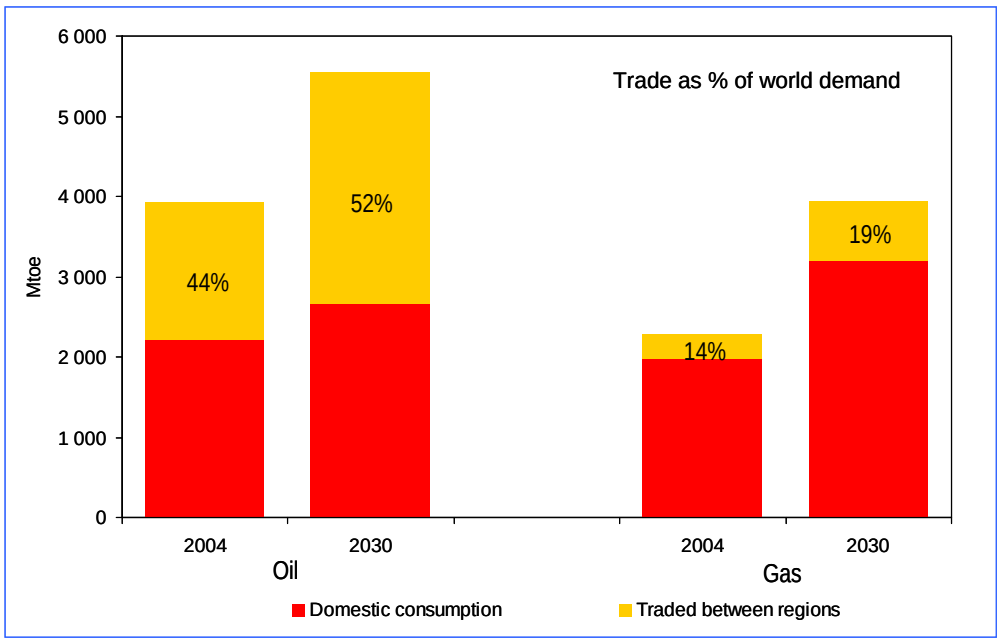
The growing regional mismatch between oil demand and production will result in a major expansion of international oil trade, both in absolute terms and as a share of supply. The volume of oil traded will almost double, grow from 36 mb/d in 2004 to 43 mb/d in 2010 and 60 mb/d in 2030. As a result, 52% of all the oil consumed worldwide will be traded between the *WEO* regions in 2030, compared with 44% in 2004 (Figure 4). Trade between countries within each grouping will also expand.

Box 2: **When Will Oil Production Peak?**

In the Reference Scenario, global oil production will not reach its peak until some time after 2030. As a result, demand will not be constrained by supply availability before that date if required investments are forthcoming. Of course, oil production must peak one day. Precisely when that happens will depend on demand and production trends. The amount of oil that can ultimately be recovered technically and economically will be a key determinant. Our analysis demonstrates that, under the extremely conservative assumption that ultimately recoverable resources are only 1 700 billion barrels, conventional oil production would peak at around 2015. Using a more optimistic assumption of 3 200 billion barrels pushes the production peak out to around 2035. In both cases, non-conventional sources, including tar sands in Canada, extra-heavy oil in Venezuela and gas-to-liquids output, fill the growing gap between conventional oil production and global oil demand.

The situation differs widely across regions. Some regions, including Europe, have already reached their production peak. But most have not. It is expected in North America around 2010. Output in sub-Saharan Africa will peak around 2020. Globally, non-OPEC conventional oil production is expected to hit a ceiling between 2010 and 2015. Production will continue to grow through to 2030 in the Middle East, North Africa, the transition economies and Latin America. The biggest increase is expected to occur in the Middle East. Consequently, the rate of expansion of installed production capacity in this region will determine when global production peaks. In both the Reference and Deferred Investment Scenarios (see below), Middle East production continues to grow, though at different rates throughout the projection period. In any event, Middle East production will most likely peak some time after global production. How soon after will depend on investment.

Figure 4: **Share of Inter-Regional Trade in World Primary Oil and Gas Demand in the Reference Scenario**

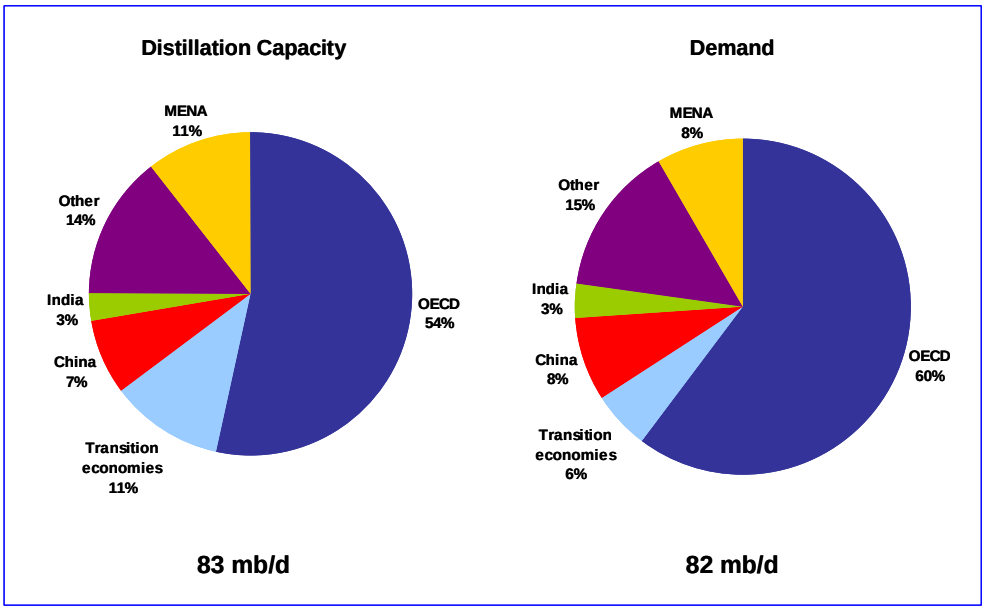


Prospects for the Global Refining Industry

The oil-refining industry is at a crossroad in its history. World refining capacity was in surplus from the mid-1970s through to the mid-1990s, due to overinvestment in the early 1970s, a downturn in demand after the oil shocks of 1973-74 and 1979-80, and the Asian financial crisis. As a result of strong growth in demand for refined products in recent years, spare capacity is rapidly diminishing and production flexibility even faster. Throughput capacity of 83 mb/d (Figure 5) was 81% utilised on average in 2005.

Allowing for maintenance, there is now little scope for further increasing utilisation, so that capacity additions will be essential to meet growing demand for refined products. In the Reference Scenario, global refining distillation capacity will need to rise to 93 mb/d in 2010 and 118 mb/d in 2030. The near-term outlook for refining capacity is based on an assessment of projects that are either planned or under construction. This assessment, together with our demand projections, suggests that capacity utilisation rates are likely to remain high through to 2010. New refinery additions, however, will struggle to keep pace with demand growth over this period on current construction plans. As a result, utilisation rates will increase to over 86% in 2010. Refining capacity will need to expand further to 118 mb/d in 2030 (Table 4). Additions to capacity, as well as higher crude runs, will be primarily directed at meeting middle distillate demand. Any shortfall in investment, leading to shortages in various types of refining capacity, would put upward pressure on petroleum product and crude oil prices.

Figure 5: **World Crude Oil Distillation Capacity and Oil Product Demand by Region in the Reference Scenario, 2004**



Note: Demand for oil products is met partly by natural gas processing, gas-to-liquids and biofuels plants.

Table 4: **Global Crude Oil Distillation Capacity in the Reference Scenario** (mb/d)

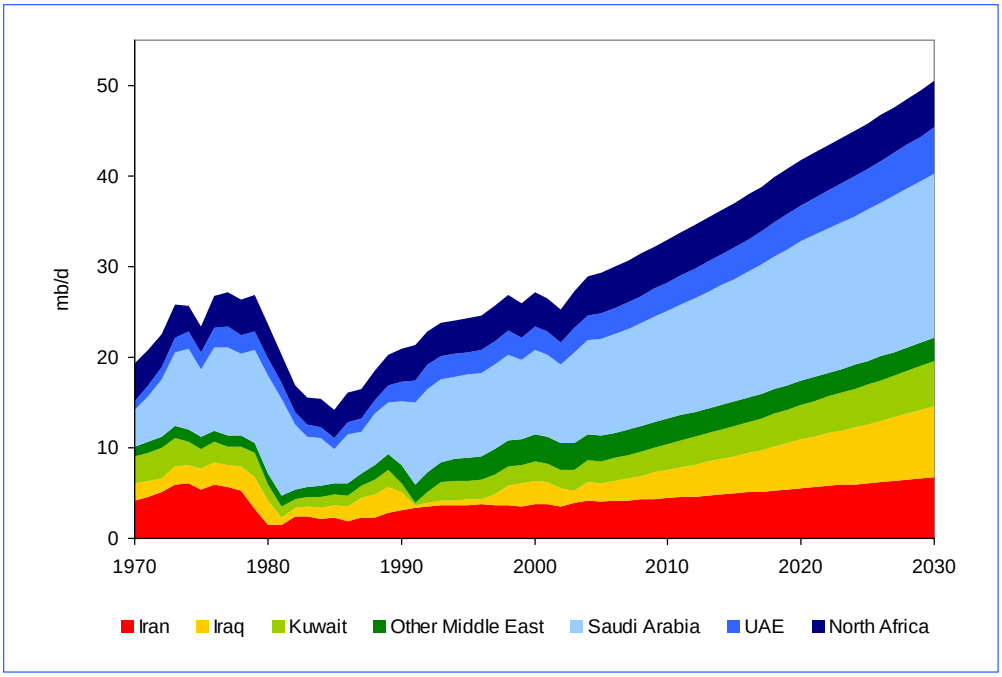
	2004	2010	2020	2030
OECD	**44.3**	**45.9**	**49.6**	**51.8**
OECD North America	20.5	22.1	24.6	25.6
OECD Pacific	8.1	8.1	8.9	9.7
OECD Europe	15.7	15.7	16.1	16.6
Transition economies	**9.5**	**9.5**	**9.7**	**10.2**
Developing countries	**29.3**	**37.2**	**47.1**	**55.7**
China	6.1	8.8	12.5	14.6
India	2.4	3.2	4.2	5.2
Middle East	7.0	8.8	10.7	12.9
North Africa	1.8	2.1	2.6	3.1
Other developing countries	12.0	14.4	17.1	19.9
World	**83.1**	**92.7**	**106.4**	**117.8**

The Role of the Middle East and North Africa

The role of the Middle East and North Africa (MENA) region – which overlaps substantially with the membership of OPEC – in global oil supply will grow substantially in the coming decades. In the Reference Scenario, MENA crude oil production (including NGLs) is projected to increase from 29 mb/d in 2004 to 37 mb/d in 2015 and to 50 mb/d in 2030 (Figure 6). The region's share of world oil production grows from 35% now to 44% in 2030. The projected increases in production are roughly commensurate with their reserves. MENA compensates for the decline of production in most other regions in the long term. Within MENA, the Middle East accountsfor almost all of the production increase. Saudi Arabia remains by far the largest supplier, its output rising from 10.4 mb/d in 2004 to 13.5 mb/d in 2015 and 18.2 mb/d in 2030. Its share of total MENA oil output remains stable at about 36%. Four countries see their shares rise: Iraq, Kuwait, Libya and the UAE. Their combined share of MENA production climbs by 10 percentage points to 41% in 2030. These projections assume that there is no major supply crunch, that

current high oil prices will decline during the current decade, then rise steadily to 2030, and that countries of the region are willing to develop new production capacities to meet the projected call on MENA oil at the prices assumed.

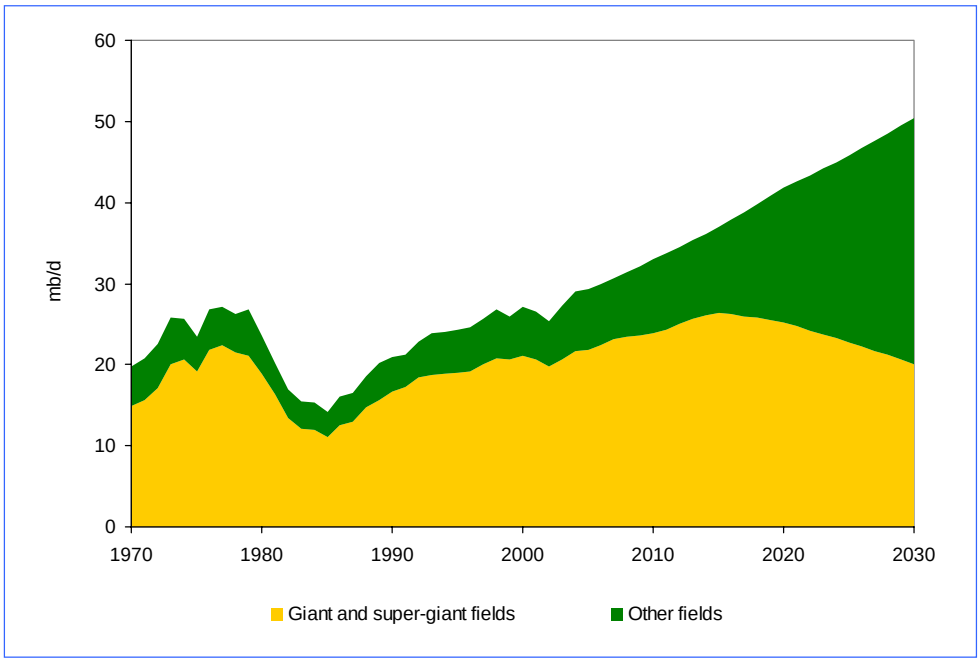
Figure 6: **MENA Crude Oil Production by Country in the Reference Scenario**



OPEC production and pricing policies will affect the level of MENA oil output as a whole. In the past three decades, MENA countries have held a significant amount of spare capacity – the largely unintended consequence of OPEC and national oil policies at a time of rising non-OPEC production. The existence of this spare capacity has played an important role in mitigating supply disruptions and sudden, unexpected surges in demand. It has also allowed producers with spare capacity to influence oil prices. Today, only Saudi Arabia has any significant amount of spare capacity and has a policy of maintaining 1.5 to 2 mb/d of spare capacity. Experience has shown that the sudden loss of even a modest volume of oil can lead to sharp increases in prices if spare capacity is limited or stock levels are low. Spare capacity is now starting to grow, but is expected to remain below 3 mb/d until the end of the current decade given current decline rates.

Giant fields (containing more than 1 billion barrels of proven reserves) and super-giant fields (holding more than 5 billion barrels) together account for 75% of reserves in MENA – a larger share than for most other regions. Those fields also account for a large share of current production, though this share has fluctuated somewhat since the 1970s as they bore the brunt of short-term production constraints imposed as a result of OPEC policies (Figure 7). Their contribution to MENA supply is projected to continue to increase over the first half of the projection period as, despite their already long production life, the growing use of advanced secondary recovery techniques boosts output in the short to medium term. Later, as the natural decline rates of giant fields increase, a growing share of oil will come from smaller fields currently awaiting development. As a result, the share of giant and super-giant fields in total MENA production drops to 40% in 2030 in the Reference Scenario. These trends are expected to raise the average cost of production. More exploration will also be needed, further adding to total production costs.

Figure 7: **MENA Crude Oil Production by Size of Field in the Reference Scenario**



MENA countries as a group will play an increasing role in growing international oil trade over the projection period. MENA's share of global exports is projected to rise from 62% to 64% in the Reference Scenario. Net oil exports from MENA countries to other regions rise from 22 mb/d in 2004 to 28 mb/d in 2015 and then surge to 39 mb/d in 2030. The region increases its exports to all the major consuming regions. Exports to developing Asian countries increase the most. Saudi Arabia retains its position as the largest oil exporter in MENA in 2030. Its exports grow from 8.3 mb/d in 2004 to 10.6 mb/d in 2015 and 14.4 mb/d in 2030 – the biggest volume increase of any country in the world. Iraq's exports grow most rapidly in percentage terms – on the assumption that security is gradually restored. Most MENA exports are still crude oil in 2030, but refined products account for a growing share.

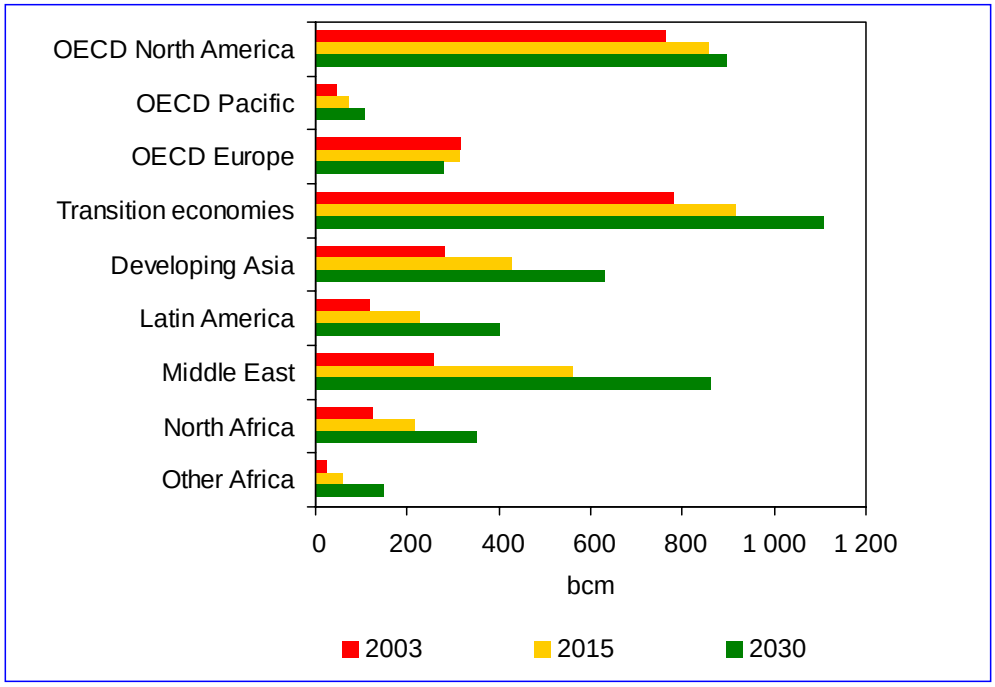
All the net oil-importing regions – the three OECD regions and developing Asia – will become even more dependent on both oil imports in total and imports from MENA, in particular, over the projection period. The OECD Pacific region remains both the most dependent on imports and the most dependent on MENA. North America also relies more and more on MENA oil. It even becomes the biggest importer from MENA countries in 2030, when its MENA imports hit 11 mb/d – a full one-quarter of total MENA exports. However, China sees the biggest percentage increase in MENA imports, which are multiplied by almost four over the projection period. China, which only became a net oil importer in 1993, has to import three-quarters of its oil needs in 2030. Most of this oil comes from the Middle East.

The Middle East is already the largest net exporter of oil products in the world. In 2004, it accounted for around half total interregional product trade. In the Reference Scenario, the Middle East's share grows to 58% in 2015 and to two-thirds by 2030. Volumes are projected to rise to 5.4 mb/d in 2015 and 6.5 mb/d in 2030. The bulk of these increases come from Saudi Arabia and Kuwait. The Middle East is already a major supplier of jet fuel and other middle distillates to Europe and heavy fuel oil to Asia. The United States will emerge as an important new market for Middle East refined-product exports, as US demand continues to outstrip domestic refining capacity. The Middle East remains a significant exporter to the Far East especially providing heavy fuels.

Gas Supply Outlook

Natural gas resources can easily meet the projected increase in global demand through the projection period, as proven reserves are now equal to about 67 years of production at current rates. The regional outlook for production stems largely from the proximity of reserves to markets and production costs. Despite substantial unit cost reductions in recent years, gas transportation remains very expensive and usually represents most of the overall cost of gas delivered to consumers. Production is projected to grow most strongly in volume terms in the Middle East, Russia and the other transition economies, which between them have most of the world's proven reserves (Figure 8).

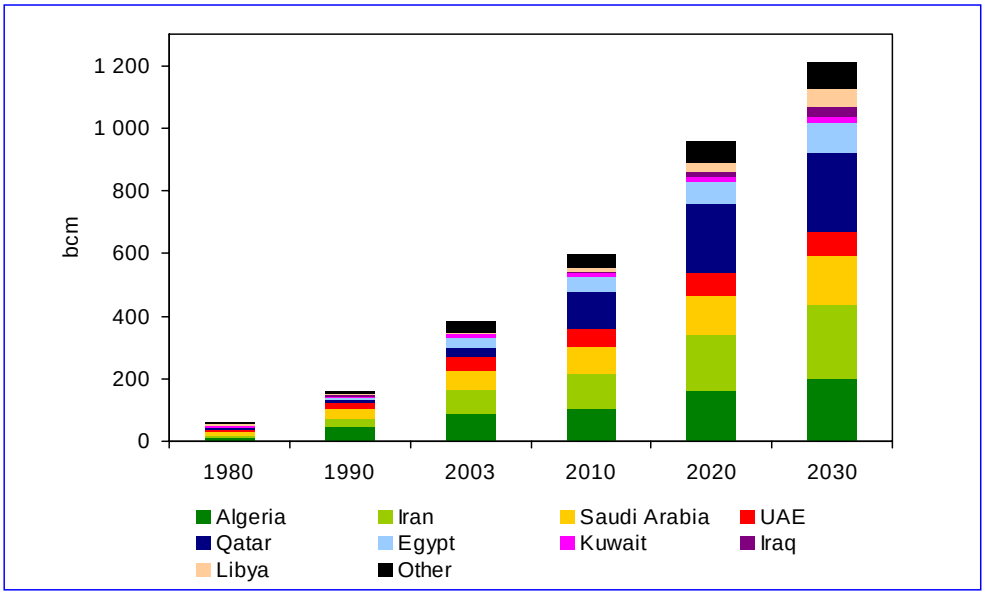
Figure 8: **Natural Gas Production by Region in the Reference Scenario**



As for oil, the share of total gas supply that is traded between regions grow strongly in the Reference Scenario, from 13% at present to 19% in 2030. The largest volume increases in net gas imports are expected to arise in Europe and North America, where Canadian exports to the United States are unable to keep pace with rising US import needs.

In the Reference Scenario, the volume of marketed MENA gas production is projected to continue to grow rapidly over the projection period, at an average rate of 4.3% per year. Output rises from 385 bcm in 2003 to some 600 bcm in 2010 and 1 210 bcm in 2030. More than two-thirds of this increase comes from the Middle East alone, which sees the largest growth of any world region. The biggest increases in production occur in Qatar, Iran, Algeria and Saudi Arabia (Figure 9). Qatar and Iran overtake Algeria as the largest producers in the region by 2010. The biggest increase in volume terms occurs in Qatar. In some cases, notably Iran, gross production increases considerably more than marketed production because of the scale of reinjection needs to boost oil production. In Iraq, some of the increase in production for reinjection is expected to be offset by reduced flaring. Abu Dhabi and Algeria are also implementing programmes to reduce gas flaring.

Figure 9: **MENA Natural Gas Production by Country in the Reference Scenario**



Part of the increase in capacity required to offset declining output from fields already in production is expected to come from further development of those fields. Additional capacity comes from the deployment of enhanced oil recovery techniques, which will yield additional associated gas. But a growing share of production comes from discovered fields that have yet to be developed and new fields that have yet to be found. Exploration for non-associated gas is expected to be stepped up in several countries. By 2015, roughly 85% of MENA gas production is sourced from fields currently in production. The share drops to just under half by 2030. No new gas will need to be discovered to attain projected output to 2030.

MENA is expected to play an increasingly important role in meeting the growth in gas demand in importing regions. Net exports from MENA countries to other regions are projected to climb from 97 bcm in 2003 to 188 bcm in 2010 and 444 bcm in 2030. A growing share of MENA exports will be in the form of LNG. Altogether, the share of LNG in total MENA exports is projected to grow from around one-third in 2003 to more than 60% in 2030. Most Middle East exports are as LNG, though some pipelines are expected to be built to Europe and South Asia after 2010. North African gas continues to be exported both by pipeline and as LNG.

Russia is projected to remain the leading supplier of gas to Europe, which will remain the biggest gas importer, and is expected to emerge as an important supplier to Asian markets. These projections hinge on adequate investment in exploration and development and in building long-distance transmission lines and LNG facilities (see below).

Oil and Gas Investment Needs

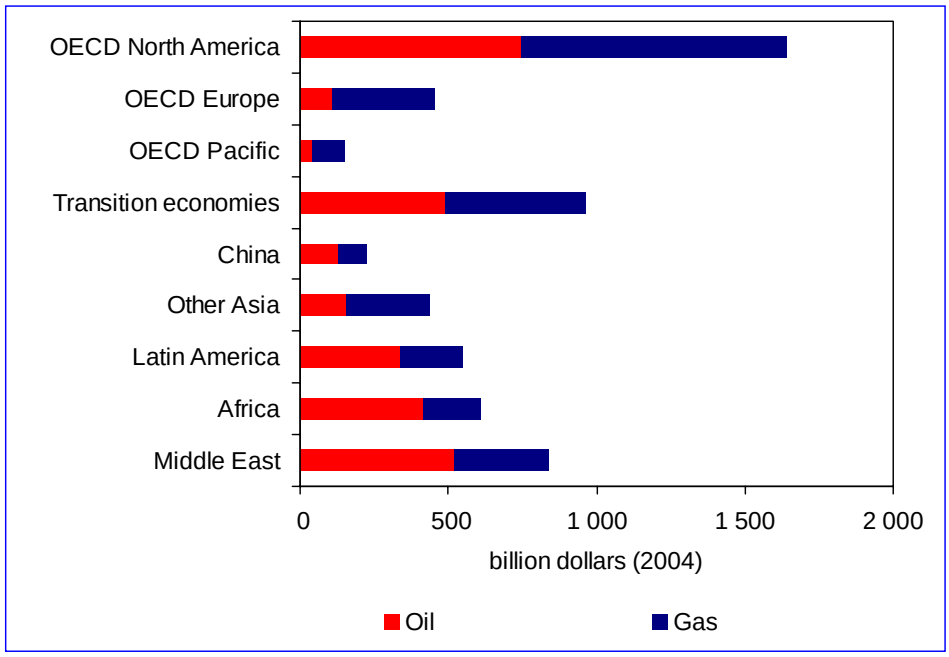
The global oil and gas projections described above would call for cumulative infrastructure investment of around $6 trillion (in year-2004 dollars) over 2004-2030. Of this investment, $2.4 trillion is needed before 2015. MENA countries alone need to invest $1.05 billion and Russia about $670 billion over 2004-2030. Worldwide investment over the entire projection period amounts to $3.2 trillion ($118 billion per year) in the oil sector and around $3 billion ($108 billion per year) in the gas sector. Developing countries require 45% of global oil and gas investments because their production and exports increase most rapidly. These investments are needed to expand supply capacity and to replace existing and future supply facilities that are retired during the projection period. Capital spending has to increase steadily through the period as existing infrastructure becomes obsolete and demand increases.

Exploration and development dominate global oil-sector investment needs, accounting for more than three-quarters of the total over the period 2004-2030. Only a quarter of upstream investment go to meet rising

demand. The rest is needed to make up for the natural decline in production from wells already in production and those that will start producing in the future. At a global level, investment needs are, in fact, far more sensitive to changes in decline rates than to the rate of growth of oil demand. Overall oil investment are highest in North America, the transition economies and the Middle East (Figure 10). Although production in OECD countries is set to decline in the coming two-and-a-half decades, their oil-investment needs are high, because their unit costs and decline rates are higher than in other regions. Upstream unit costs are lowest in the Middle East.

Exploration and development of gas fields will absorb 62% of global gas investment. Building downstream infrastructure – high-pressure transmission pipelines, local distribution networks, storage facilities, LNG liquefaction and regasification plants and LNG carriers – will account for the rest. An increasing share of investment will go to LNG supply. The OECD as a whole will account for almost half of global gas investment. This is close to the OECD's share of the increase in global demand over the projection period. North America alone will claim more than a quarter of new investment. Unit capital costs and production-decline rates are much higher in the industrialised countries than in other parts of the world. The main exporting regions – Russia, the Caspian region, the Middle East and Africa – will need to attract most investment outside the OECD. Although a bigger share of drilling will occur in lower-cost regions, a doubling of global production and a shift in drilling to offshore fields will cause an overall increase in upstream investment. Gas-processing costs, included in exploration and development, may also rise, as the quality of reserves deteriorates.

Figure 10: **Cumulative Global Oil and Gas Investment in the Reference Scenario, 2004-2030**



Financing the required investments in non-OECD countries will be a major challenge, especially in non-OECD countries. Globally, there is enough money to finance projected oil and gas investment needs. Domestic savings alone are much larger than the capital required for energy projects. But in some regions, those capital needs represent a large share of total savings. Although sufficient capital will be available overall from domestic and international sources, it is far from certain that the entire infrastructure needed in the future will be fully financed in all cases. Mobilising the investment required will depend on whether returns are high enough to compensate for the risks involved. More than in the past, capital needed for energy projects will have to come from private sources, as governments continue to withdraw from the provision of energy services. Foreign direct investment is expected to become an increasingly important

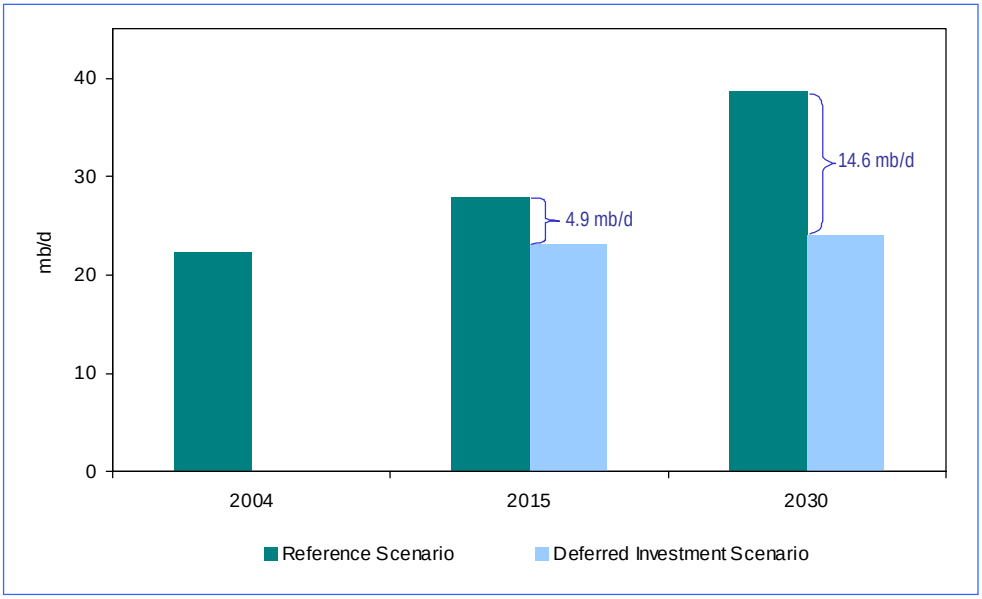
source of capital in non-OECD regions. Raising private finance will depend critically on the establishment by governments of an attractive investment framework and climate.

Oil and gas prices will play a key role in attracting investment to the sector. In recent years, upstream global oil and gas investment has tended to fluctuate with changes in oil prices. The openness of countries with large oil resources to foreign direct investment will be another important factor in determining how much upstream investment occurs and where. Today, three major oil-producing countries – Kuwait, Mexico and Saudi Arabia – remain totally closed to outside investment. Access to many others, such as Russia and Iran, is restricted. There is evidence that investment in upstream oil and gas projects by private companies has increased significantly in recent years, but part of that increase may reflect rising unit costs and faster decline rates, and so may not lead to large net additions to production capacity.[2]

The rate of investment in developing crude oil production capacity in the Middle East and North Africa (MENA) region is a particularly critical uncertainty for world energy markets. A Deferred Investment Scenario, also presented in the 2005 *Outlook*, analyses how energy markets might evolve if upstream investment in each MENA country were to remain constant as a share of GDP at the average level of the past decade. This would result in a $110 billion, or 23%, drop in cumulative upstream MENA oil investment over 2004-2030.

Lower investment on this scale causes MENA oil production to drop by almost a third by 2030 compared with the Reference Scenario. Production falls further than investment by the end of the projection period because of the cumulative effect over the projection period. In 2030, total MENA output reaches 35 mb/d, compared with 50 mb/d in the Reference Scenario. Saudi Arabia's production, at 14 mb/d in 2030, is more than 4 mb/d lower than in the Reference Scenario. MENA's share of world oil production drops from 35% in 2004 to 33% in 2030 (against a rise to 44% in the Reference Scenario). As a result, MENA oil exports are 17% lower in 2015 and almost 40% lower in 2030 (Figure 11).

Figure 11: **Middle East and North African Net Oil Exports in the Reference and Deferred Investment Scenarios**



The impact of lower MENA crude oil production on global oil supply is offset to some extent by higher non-MENA production, stimulated by higher prices. Part of the increase in non-MENA output comes from

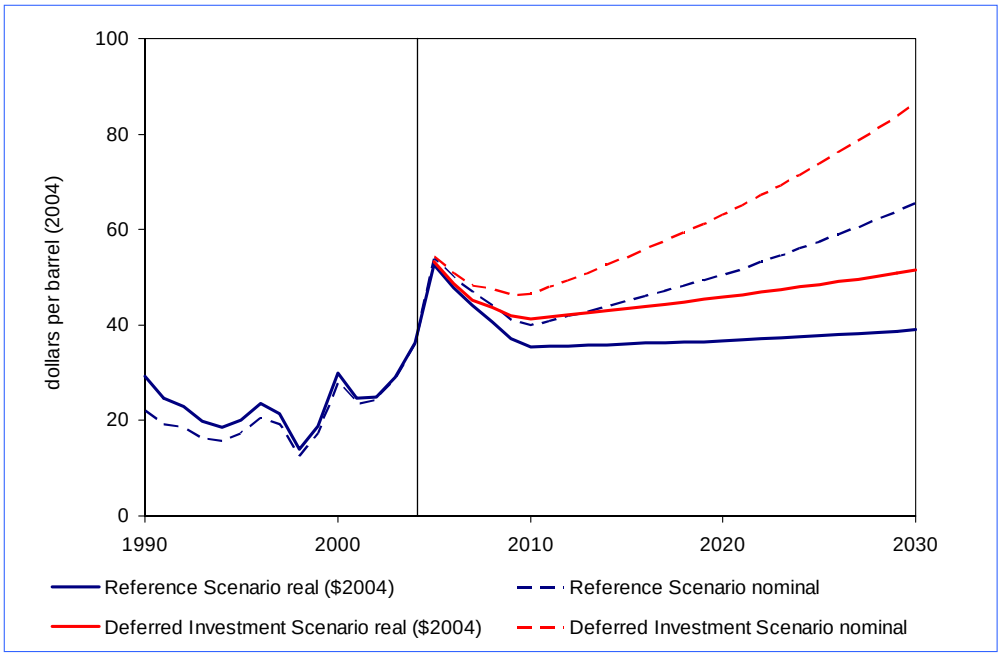
[2] The results of a detailed survey and analysis of energy investment trends and plans will be presented in the forthcoming *World Energy Outlook 2006*.

non-conventional sources – mostly tar sands in Canada and extra-heavy oil in Venezuela. Non-MENA output climbs to 64 mb/d in 2015 and 70 mb/d in 2030 – some 5.1 mb/d higher than in the Reference Scenario and 17 mb/d more than in 2004. World oil production, at 105 mb/d, is 10 mb/d lower than in the Reference Scenario.

The reduction in MENA oil production in the Deferred Investment Scenario leads to lower gas production in the region in two ways. First, associated gas production is reduced in line with oil output. Second, higher gas prices that result from the increase in oil prices choke off global demand and reduce the call on MENA gas exports. MENA gas production is 90 bcm, or 12%, lower in 2015 and 240 bcm, or 20%, lower in 2030 than in the Reference Scenario. Output in 2030 is still 590 bcm higher than in 2003. Gas exports fall by 31% in 2015 and 46% in 2030, with Qatar's falling furthest in absolute terms.

In the Deferred Investment Scenario, the international crude oil price is significantly higher than in the Reference Scenario over the projection period. In the Reference Scenario, the average IEA import price is assumed to fall back from recent highs to around $36 (in year-2004 dollars) in 2015, and then to rise slowly to $39 in 2030 (Figure 12). In the Deferred Investment Scenario, the price increases gradually over time, relative to the Reference Scenario. By 2030, it is about $13 higher ($21 in nominal terms) – an increase of almost one-third. Natural gas prices rise broadly in line with oil prices. The coal price also increases slightly.

Figure 12: **Middle East and North African Net Oil Exports in the Reference and Deferred Investment Scenarios**



As a result of higher prices and lower world GDP, global energy demand is reduced by about 6% in 2030, compared with the Reference Scenario. World GDP growth, the main driver of energy demand, is on average 0.23 percentage points per year lower throughout the projection period. Lower oil and gas revenues and higher prices cause primary energy-demand growth in MENA countries to slow, but less markedly than in non-MENA regions. Among the primary fuels, global demand for oil falls most. Global oil demand, at 105 mb/d in 2030, is 10 mb/d lower than in the Reference Scenario. Higher oil prices encourage faster improvements in end-use efficiency, primarily in road vehicles and aircraft. They also encourage faster deployment of alternative fuels, such as biofuels. Gas demand worldwide falls by by 370 bcm, or 8%, in 2030 compared with the Reference Scenario, mainly as a result of lower demand for fuel inputs to power

generation. Higher gas and electricity prices choke off electricity demand and encourage switching to other energy sources.

The results of this analysis suggest that MENA producers would lose out financially were investment to be deferred in the way assumed in the Deferred Investment Scenario. This is because the increase in prices would fail to compensate for lower export volumes. The cumulative value of MENA oil and gas export revenues over 2004-2030 is about $1 000 billion lower than in the Reference Scenario, because lower export volumes more than outweigh the increase in prices. This is almost four times more than the reduction in investment. Revenues also fall in net present value terms. Oil accounts for about 70% of the fall in revenues, though the *percentage* fall in revenues is higher for gas.

Uncertainty about future supply-side infrastructure investments is by no means limited to MENA or to the upstream. There are signs that under-investment in gas-production facilities and transmission pipelines in Russia and Central Asia could lead to a supply crunch in the next few years, given the prospects of rising Russian demand, increasing export commitments to Europe and dwindling production from Gazprom's mature super-giant gas fields. Despite record profits thanks to high gas-export prices, Gazprom has not significantly increased investment in new upstream projects, focusing instead on expanding its participation in downstream activities overseas and in oil. The current rate of investment in the Russian gas sector is well below the average $10 billion per year that we project will be needed between 2004 and 2030. The lack of competition in the Russian gas sector is an impediment to the efficient and timely development of the countries gas resources.

There is also considerable uncertainty about the prospects for investment in new refining capacity – both crude oil distillation and secondary upgrading facilities. Environmental restrictions and local opposition are hampering capacity additions in many parts of the world, especially in OECD countries. And uncertainty about future investment returns may discourage refiners from proceeding with very costly new projects. Even when refining projects are judged to be profitable, integrated companies may prefer to direct capital to upstream projects, which typically show a higher rate of return. Global refinery investment needs are expected to amount to close to $500 billion (in year-2004 dollars) though to 2030, an average of almost $19 billion per year. Any shortfall in investment, leading to shortages in different types of refining capacity would put upward pressure on product and crude oil prices.

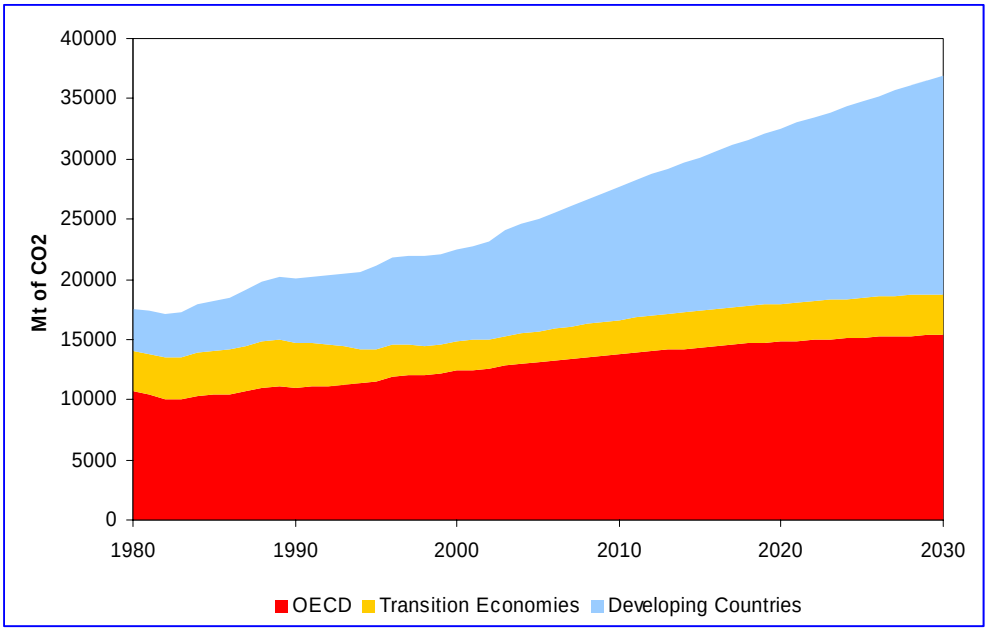
Policy Implications

The energy trends described in both the Reference and Deferred Investment Scenarios raise serious concerns about energy security and the environment. The growing volume of imports as well as increased reliance on a small number of countries – notably Russia and the big Middle East producers – will have important and complex implications for energy security in consuming countries. Increased international trade in oil and gas will bring economic benefits to both exporting and importing countries. Nonetheless, the prospect of a few countries in the MENA region claiming a bigger share of global oil and gas supply and trade naturally raises concerns about the risk of major supply disruptions because of political instability in parts of the region and past experience of disruptions to oil supplies from some countries in the region. A particular cause for concern is the growing reliance on strategic transportation channels through which almost all the oil and gas exported by Middle Eastern countries must flow. In addition, oil and gas production will become increasingly concentrated in fewer and fewer countries. This will add to the vulnerability to a disruption and the risk that those countries will seek to use their dominant market position to force up prices at some point in the future.

In addition, rising global energy consumption would drive up climate-destabilising carbon-dioxide emissions, calling into question the long-term sustainability of the global energy system. The projected trends in energy use in the Reference Scenario imply that global energy-related carbon-dioxide emissions would increase by 1.6 % per year over 2003-2030. Emissions exceed 37 gigatonnes in 2030, an increase of 13 billion tonnes, or 52%, over the 2003 level. By 2015, energy-related CO_2 emissions are 41% higher than in 1990. Power generation contributes around half the increase in global emissions from 2003 to 2030. Developing countries are responsible for almost three-quarters of the increase in global CO_2 emissions from 2003 to 2030, overtaking the OECD as the leading contributor to global emissions early in the 2020s. The increase in emissions from China alone exceeds the increase in all OECD countries and Russia combined. OECD countries accounted for 52% of total emissions in 2003, developing countries for 36%

and transition economies for 10%. By 2030, the developing countries account for 49%, the OECD countries for 42% and the transition economies for 9% (Figure 13).

Figure 13: **World Energy-Related CO_2 Emissions by Region in the Reference Scenario**



More vigorous government policies in consuming countries could, and no doubt will, steer the world onto a different, more sustainable energy path. The leaders of the G8 and several large developing countries, meeting at Gleneagles in July 2005, acknowledged the need for stronger action to combat rising consumption of fossil fuels and related greenhouse-gas emissions. Most OECD governments have declared their intention to do more and other countries around the world can be expected to follow suit. Such policies are all the more likely to be implemented if energy prices remain high.

An Alternative Policy Scenario analyses the global impact of environmental and energy-security policies that countries around the world are already considering, as well as the effects of faster deployment of energy-efficient existing technologies. In this scenario, global energy demand and carbon-dioxide emissions are significantly lower than in the Reference Scenario. World global primary energy demand in 2030 reaches 14 658 Mtoe – 1 613 Mtoe, or almost 10%, less than in the Reference Scenario (Table 5). Primary energy demand grows by 1.2% per year, 0.4 percentage points less than in the Reference Scenario. The effect of energy-saving and fuel diversification policies on energy demand grows throughout the projection period, as the stock of energy capital is gradually replaced and new measures are introduced. Global energy savings achieved by 2015 are modest, at about 540 Mtoe, or 4%.

Table 5: **World Primary Energy Demand in the Reference and Alternative Policy Scenarios**
(Mtoe)

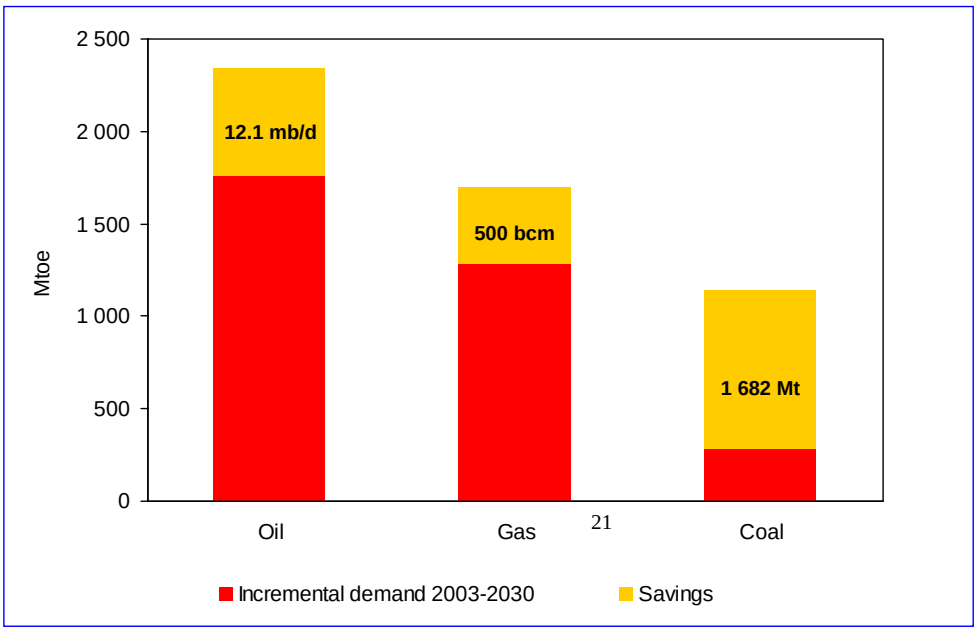
	Reference Scenario			Alternative Policy Scenario		
	2003	2030	2003-2030*	2030	2003-2030*	Difference with the Reference Scenario in 2030
Coal	2 582	3 724	1.4%	2 866	0.4%	-23%
Oil	3 785	5 546	1.4%	4 967	1.0%	-10%
Gas	2 244	3 942	2.1%	3 528	1.7%	-10%
Nuclear	687	767	0.4%	878	0.9%	14%
Hydro	227	368	1.8%	370	1.8%	0.4%
Biomass and waste	1 143	1 653	1.4%	1 705	1.5%	3%
Other renewables	54	272	6.2%	344	7.1%	27%
Total	**10 723**	**16 271**	**1.6%**	**14 658**	**1.2%**	**-10%**

* Average annual rate of growth.

Reduced oil and gas use account for most of the overall fall in energy demand vis-a-vis the Reference Scenario. Oil and gas demand each fall by 10% (Figure 14). Demand for oil in the Alternative Policy Scenario rises to just under 5 000 Mtoe in 2030, 580 Mtoe, or 10%, lower than in the Reference Scenario. But it still accounts for 34% of world primary energy demand in 2030, the same share as in the Reference Scenario. Two-thirds of these savings come from the transport sector, as fuel efficiency improves and alternative fuel vehicles – powered by compressed natural gas or biofuels – or gasoline-powered hybrids penetrate the market. Almost three-quarters of the savings in gas demand come from power generation.

The reduction in demand for coal is even greater, both in absolute and percentage terms, thanks to the use of more efficient technology and switching to less carbon-intensive fuels. By contrast, the use of carbon-free non-hydro renewables, excluding biomass, is almost 30% higher in 2030 than in the Reference Scenario. Biomass, hydropower and nuclear energy also grow. Renewables partially displace fossil-fuel consumption. By 2030, global consumption of biomass is 50 Mtoe higher in the Alternative Policy Scenario than in the Reference Scenario. Most of the net increase in the use of renewables results from OECD government incentives to promote the use of biomass in the power sector and in transportation. Consumption of renewables other than biomass – mainly in power generation – increases even more, by 70 Mtoe in 2030 – a 27% increase compared with the Reference Scenario.

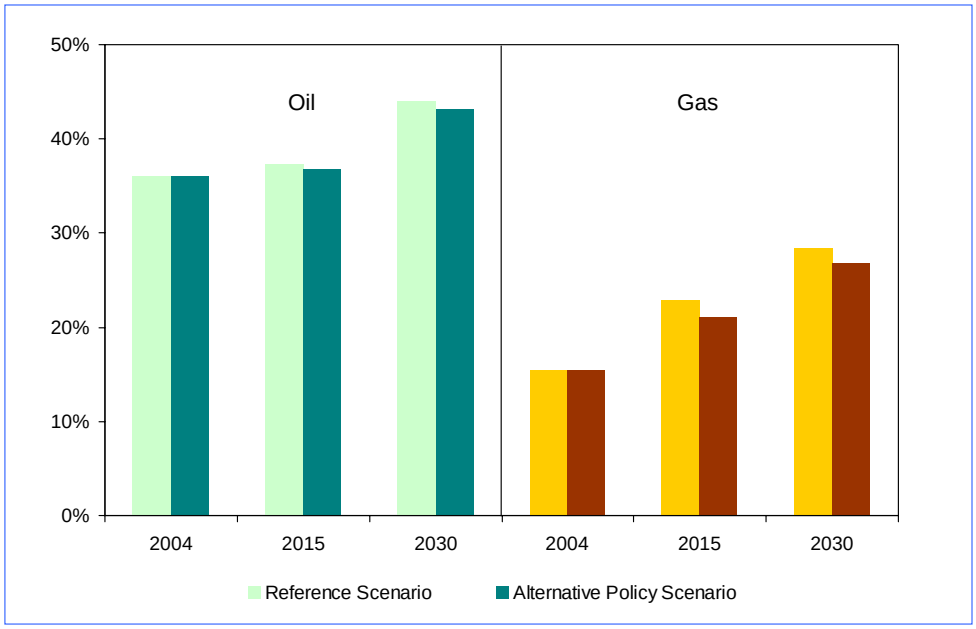
Figure 14: **Incremental World Primary Fossil Fuel Demand in the Alternative Policy Scenario and Savings Compared with the Reference Scenario, 2003-2030**



By contrast, the use of carbon-free non-hydro renewables, excluding biomass, is 16% higher in 2015 than in the Reference Scenario and 27% higher in 2030. The use of biomass, hydropower and nuclear energy also grows. Renewables partially displace fossil-fuel consumption. Global consumption of biomass is 50 Mtoe higher in 2030. Most of the net increase in the use of renewables results from OECD government incentives to promote their use in the power sector and in transportation. Consumption of renewables other than biomass – mainly in power generation – increases even more, by 20 Mtoe in 2015 and 70 Mtoe in 2030.

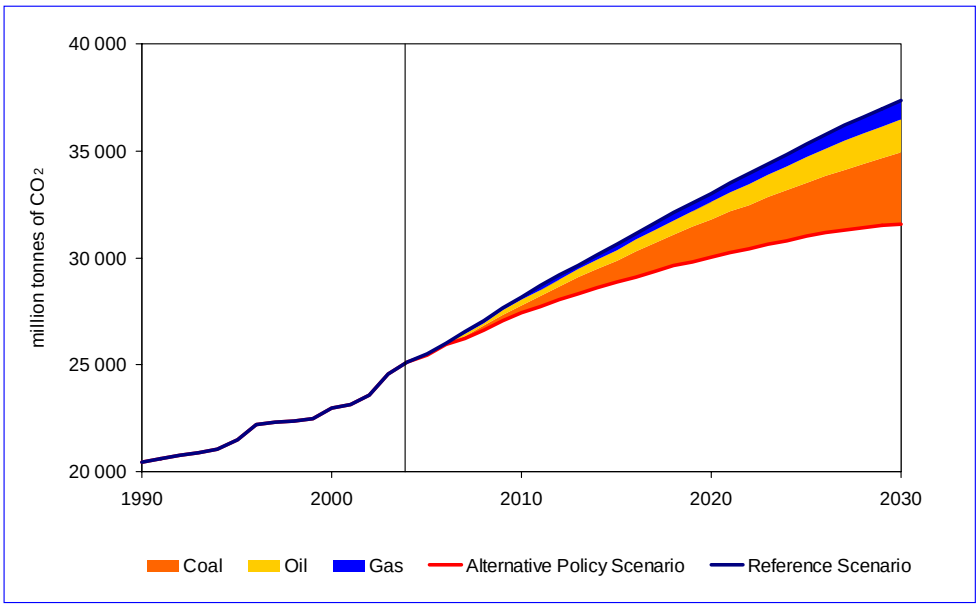
The fall in primary energy demand in the Alternative Policy Scenario relative to the Reference Scenario leads to a major reduction in MENA oil and gas supply. Global oil demand is reduced by 4 mb/d in 2015 and 12 mb/d in 2030. This leads to a reduction in MENA production of 1.9 mb/d in 2015 and 5.9 mb/d reduction in 2030. Global demand for natural gas is 150 bcm lower in 2015 and 500 bcm lower in 2030. As a result, MENA gas production falls by 100 bcm in 2015 and almost 200 bcm in 2030, reaching 1 010 bcm. Despite these reductions, MENA production and exports of both oil and gas still rise significantly from current levels. Oil exports climb from 22 mb/d in 2004 to 26 mb/d in 2015 and 34 mb/d in 2030. Gas exports similarly grow from 100 bcm in 2004 to 200 bcm in 2015 and 370 bcm in 2030. The share of MENA in global oil and gas supply also grows, albeit slightly less than in the Reference Sceanrio (Figure 15).

Figure 15: **MENA Share of Global Oil and Gas Supply in the Reference and Alternative Policy Scenarios**



Lower overall energy consumption and a larger share of less carbon-intensive fuels in the primary energy mix together yield a 6%, or 1.8 gigatonne, reduction in global carbon-dioxide emissions compared to the Reference Scenario in 2015. By 2030, the reduction is 16%, or 5.8 gigatonnes (Figure 16). The bulk of the reduction comes from lower coal use, especially in power generation in non-OECD countries. This results mainly from the reduction in electricity demand brought about by new endues efficiency policies.

Figure 16: **Global Energy-Related CO_2 Emissions in the Reference and Alternative Policy Scenarios**



Towards a Sustainable Energy Future

The Alternative Policy Scenario demonstrates that if governments around the world were to implement new policies they are considering today, aimed at addressing environmental and energy-security concerns, fossil-fuel demand and carbon-dioxide emissions would be significantly lower. Policies to combat rising CO2 emissions could help to enhance the energy security of consuming countries – to the extent that they reduce the consumption of oil and gas and the need to import those fuels. But even in this scenario, global energy demand in 2030 would still be 37% higher than today and the volume of MENA hydrocarbon exports would still grow significantly. The government actions envisioned in the Alternative Policy Scenario could eventually stabilise carbon-dioxide emissions, but they could not reduce them significantly using existing technology. It is clear that achieving a truly sustainable energy system will depend on major technological breakthroughs that radically alter how we produce and use energy, as well as on far more radical policy action than currently envisaged.

Carbon capture and storage technologies, which are not taken into account in either the Reference or the Alternative Scenario, hold out the tantalising prospect of using fossil fuels in a carbon-free way. Advanced nuclear-reactor designs or breakthrough renewable technologies could one day help free us from our dependence on fossil fuels. But these technologies will have to become much cheaper if they are to be

widely applied. This is unlikely to happen within the next quarter of a century. Developing and deploying new clean technologies in these and other areas are the key to making the global energy system more economically, socially and environmentally sustainable in the long term. Governments have a critical role to play in accelerating this process as a matter of urgency.

The results of the Alternative Policy and Deferred Investment Scenarios imply that the biggest uncertainty surrounding global energy market prospects is the price of oil. Demand for oil is expected to continue to grow in any plausible scenario, though the rate of increase varies. In practice, the policies of producing and consuming countries will change over time in response to each other, to market developments and to shifts in market power. If upstream or downstream investment falters in MENA countries or elsewhere and oil (and other energy) prices rise as a result, the more likely it becomes that consuming countries will adopt additional policies to curb demand growth and reliance on MENA. This would have the effect of tempering the long-term impact on prices of lower MENA investment. It would also amplify the depressive effect of higher prices on oil and gas demand. The more successful the importing countries' policies are in curbing their hydrocarbon imports, the more likely it is that the producing countries will adopt policies to sustain their production and their global market share. Lower prices would result.

These interactions illustrate the case for improving market transparency, for more effective mechanisms for exchanging information between oil producers and consumers, and for a more profound dialogue between them. Concerns among consuming countries about security of supply are matched by those among producing countries about security of demand. Consuming countries will continue to seek to diversify their energy mix, while producing countries will continue to seek to diversify their economies. Together, consumer and producer governments can improve the mechanisms by which they seek to reconcile their interests and achieve mutually beneficial outcomes.