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World Energy Outlook 2005

Summary in English

Executive summary

The oil and gas resources of the Middle East and North Africa (MENA) will be critical to meeting the world's growing appetite for energy. The greater part of the world's remaining reserves lie in that region. They are relatively under-exploited and are sufficient to meet rising global demand for the next quarter century and beyond. The export revenues they would generate would help sustain the region's economic development. But there is considerable uncertainty about the pace at which investment in the region's upstream industry will occur, how quickly production capacity will expand and, given rising domestic energy needs, how much of the expected increase in supply will be available for export. The implications for both MENA producers and consuming countries are profound. This *Outlook* seeks to shed light on these very complex issues.

Global energy needs are likely to continue to grow steadily for at least the next two-and-a-half decades. If governments stick with current policies – the underlying premise of our Reference Scenario – the world's energy needs would be more than 50% higher in 2030 than today. Over 60% of that increase would be in the form of oil and natural gas. MENA's share of global oil and gas output would grow substantially, as long as MENA countries invest enough in energy production and transportation infrastructure. But the global trends in the Reference Scenario would raise several serious concerns. Climate-destabilising carbon-dioxide emissions would continue to rise, calling into question the long-term sustainability of the global energy system. And the sharply increased dependence of consuming regions on imports from a small number of MENA countries would exacerbate worries about the security of energy supply.

More vigorous government policies in consuming countries could, and no doubt *will*, steer the world onto a different energy path. The leaders of the G8 and several large developing countries, meeting at Gleneagles in July 2005, acknowledged as much when they called 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.

Consuming-country policies could curb demand growth and reduce the world's reliance on MENA oil and gas. A World 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. 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. Far more radical policy action and technology breakthroughs would be needed to reverse these trends.

A critical uncertainty is whether the substantial investments needed in the upstream hydrocarbons sector in MENA countries will, in fact, be forthcoming. In a Deferred Investment Scenario, much lower MENA oil production drives up the international price of oil and, with it, the price of gas. Higher energy prices, together with slower economic growth, would choke off energy demand in all regions and would, therefore, reduce demand for oil and gas compared with the Reference Scenario. MENA exports, nonetheless, continue to grow. Current market instability and the recent surge in oil prices demonstrate the vital importance of adequate investment in upstream and downstream capacity and the threat posed by surging global demand.

The prospects for MENA's role in global energy supply developments have far-reaching implications for the global economy. The governments of producing and consuming countries alike have a mutual interest in addressing the concerns highlighted in this *Outlook*. The information and analysis presented here can provide a solid quantitative framework for understanding the challenges, deepening the dialogue between producers and consumers and devising appropriate policy responses.

World Energy Demand will Grow Inexorably, Absent New Policies

In the absence of new government policies, the world's energy needs will rise inexorably. In the Reference Scenario, world primary energy demand is projected to expand by more than half between now and 2030, an average annual growth rate of 1.6%. By 2030, the world will be consuming 16.3 billion tons of oil equivalent – 5.5 billion toe more than today. More than two-thirds of the growth in world energy use will come from the developing countries, where economic and population growth are highest. The international energy prices that underpin these projections have been revised upwards from last year's *Outlook*. The average IEA crude oil import price is now assumed to ease to around $35 per barrel in 2010 (in year-2004 dollars) as new crude oil production and refining capacity come on stream. It is then assumed to rise slowly to $37 in 2020 and $39 in 2030. In nominal terms, the price will reach $65 in 2030.

Fossil fuels will continue to dominate energy supplies, meeting more than 80% of the projected *increase* in primary energy demand. Oil remains the single most important fuel, with two-thirds of the increase in oil use coming from the transport sector. Demand reaches 92 mb/d in 2010 and 115 mb/d in 2030. The lack of cost-effective substitutes for oil-based automotive fuels will make oil demand more rigid. Natural gas

demand grows faster, driven mainly by power generation. It overtakes coal as the world's second-largest primary energy source around 2015. The share of coal in world primary demand falls a little, with demand growth concentrated in China and India. The share of nuclear power declines marginally, while that of hydropower remains broadly constant. The share of biomass declines slightly, as it is replaced with modern commercial fuels in developing countries. Other renewables, including geothermal, solar and wind energy, grow faster than any other energy source, but still account for only 2% of primary energy demand in 2030.

The world's energy resources are adequate to meet the projected growth in energy demand in the Reference Scenario. Global oil reserves today exceed the cumulative projected production between now and 2030, but reserves will need to be "proved up" 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. The exact cost of finding and exploiting those resources over the coming decades is uncertain, but will certainly be substantial. Cumulative energy-sector investment needs are estimated at about $17 trillion (in year-2004 dollars) over 2004-2030, about half in developing countries. Financing the required investments in non-OECD countries is one of the biggest challenges posed by our energy-supply projections.

The global oil-refining industry has an urgent need for more distillation and upgrading capacity. As a result of strong growth in demand for refined products in recent years, spare capacity has been rapidly diminishing and flexibility has fallen even faster. Effective capacity today is almost fully utilised, so growing demand for refined products can only be met with additional capacity. Upgrading capacity will be needed even more than distillation capacity, since demand will continue to shift to lighter products, while crude oil production is becoming heavier, with higher sulphur content.

MENA Domestic Energy Demand is Set to Surge…

Rapidly expanding populations, steady economic growth and heavy subsidies will continue to drive up MENA energy demand. In the Reference Scenario, demand is projected to grow on average by 2.9% per year between now and 2030. As a result, demand more than doubles. By 2030 the MENA region will account for 7.5% of global primary energy demand, two percentage points more than today. The biggest contributors to demand growth will be Saudi Arabia and Iran. These two countries will account for some 45% of MENA energy demand in 2030, about the same as today. The fastest *rate* of energy-demand growth will occur in Qatar.

Most MENA countries will continue to rely almost exclusively on oil and natural gas to meet their energy needs. Gas will overtake oil after 2020 as the region's main energy source for domestic use, thanks to policies aimed at freeing up oil for export. The use of other fuels increases, but together they account for less than 4% of primary energy demand in 2030 – hardly more than at present.

Despite rapid growth in MENA energy use, per capita consumption projected for 2030 will still be barely half the current level in OECD countries. Large discrepancies in per capita energy use among MENA countries will remain. In most of

the Gulf countries, per capita *electricity* consumption will remain among the highest in the world – mainly the consequence of heavy price subsidies which lead to inefficient energy use and of the hot climate which necessitates considerable air-conditioning.

The power and water sectors will absorb a growing share of the region's total primary energy use as electricity and desalinated water needs expand rapidly. Heavy subsidies to both services are accentuating this trend. Gas-fired power plants, mostly using combined-cycle gas-turbine technology, will meet 71% of new generating-capacity needs. Water desalination, an energy-intensive process usually integrated with power production, will account for more than one-quarter of the increase in total fuel use in the power and water sector in Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Algeria and Libya combined.

…but Even Faster Growth in MENA Output will Boost Exports

Output of oil and natural gas in the MENA region is poised for rapid expansion. In the Reference Scenario, oil production (including natural gas liquids) is projected to rise from 29 mb/d in 2004 to 33 mb/d in 2010 and to 50 mb/d by 2030. In some countries, this may require opening up the upstream sector to foreign investment. The contribution of giant oilfields to total production will drop sharply, from 75% today to 40% in 2030, as mature giant fields decline and new developments focus more on smaller fields.

Production in MENA countries, especially in the Middle East, increases more rapidly than elsewhere because their resources are greater and their production costs lower. Growth in aggregate production outside MENA is expected to slow over the *Outlook* period. Saudi Arabia, which has the largest proven reserves of oil in the world, will remain by far the largest supplier. Its output will rise from 10.4 mb/d in 2004 to 11.9 mb/d in 2010 and just over 18 mb/d in 2030. Iraq is expected to see the fastest rate of production growth, and the biggest increase in volume terms after Saudi Arabia. In some countries, including Iraq, increased production will hinge on large-scale foreign investment.

On this basis, MENA's share of world oil production would jump from 35% in 2004 to 44% in 2030. Almost all the increase comes from the Middle East. Saudi Arabia's share of total MENA oil output in 2030 will be much the same as today, at about 36%. Four countries will see their share in MENA output increase: Iraq, Kuwait, the UAE and Libya.

MENA production outpaces growth in domestic demand, allowing the region's net oil exports to rise by three-quarters over the *Outlook* period, from 22 mb/d in 2004 to 25 mb/d in 2010 and 39 mb/d by 2030. Most exports will still be as crude oil in 2030, but refined products will account for a growing share. Exports to developing Asian countries will increase most, but will grow to all the major consuming regions.

MENA gas prduction is projected to grow even more rapidly than oil, trebling over the projection period to 1 210 billion cubic metres in 2030. This is faster than almost any other major world region. The biggest volume increases in the region occur in Qatar, Iran, Algeria and Saudi Arabia. A third of MENA gas output comes from North Field/South Pars, a field shared by Qatar and Iran, and Hassi R'Mel in Algeria. This share

will increase as they are further developed. Demand for MENA gas will be driven by strong global demand and dwindling output in many other gas-producing regions. The bulk of the increase in output will be exported, mostly as liquefied natural gas. Net exports from MENA countries to other regions are projected to more than quadruple to 440 bcm in 2030, with a marked shift in sales to Western markets. Europe will remain the primary destination for North African gas exports. Major gas importers, including most OECD countries and developing Asia, will become ever more dependent on imports from MENA countries.

MENA oil- and gas-export revenues, which have surged in the last few years, will remain high. Aggregate MENA oil and gas revenues are projected to rise from about $310 billion in 2004 to $360 billion in 2010 and $635 billion in 2030. Natural gas will make a growing contribution. Cumulative revenues will far exceed the investment needed to make them possible. Total oil and gas investment is projected to amount to about $1 trillion over the period 2004-2030 (in year-2004 dollars), or $39 billion per year.

The need for more comprehensive and transparent data on oil and gas reserves in all regions is a pressing concern. The preparation of this *Outlook* involved an extensive effort to collect the best available data on reserves from official and informal sources. But there are inconsistencies in the way reserves are defined and measured, and a lack of verifiable data on reserves and of a universally recognised reporting system makes it difficult to assess the quality of data on reported proven reserves in many regions, including MENA. Uncertainties about just how big reserves are and the true costs of developing them are casting shadows over the oil market outlook and heightening fears of higher costs and prices in future.

Lower MENA Oil Investment would Radically Alter the Global Energy Balance

A major shortfall in MENA investment in upstream oil would radically alter the global energy balance. In recent years, global investment, crude oil production capacity and refining capacity have lagged the rise in demand, driving up oil prices. Our projections in the Reference Scenario involve a doubling of the level of annual upstream investment in MENA countries. It is far from certain that all that investment will be forthcoming: MENA governments could choose *deliberately* to develop production capacity more slowly than we project in our Reference Scenario. Or external factors such as capital shortages could *prevent* producers from investing as much in expanding capacity as they would like. The Deferred Investment Scenario 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 almost 40% lower in 2030. By contrast, higher prices stimulate an 8% increase in non-MENA oil production compared to the Reference Scenario. Natural gas production in MENA countries also falls significantly, due to lower global demand and lower output of associated gas. Gas exports fall by 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 $35 (in year-2004 dollars) in 2010, and then to rise slowly to $39 in 2030. In the Deferred Investment Scenario, the price increases gradually over time, relative to the Reference Scenario. It is about $13 higher in 2030, or $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. Energy prices would become more volatile.

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. 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. Demand for both gas and coal also falls, mainly as a result of lower demand for fuel inputs to power generation.

Our analysis suggests that MENA producers would lose out financially were investment to be deferred in the way assumed in the Deferred Investment Scenario. The increase in prices fails to compensate for lower export volumes. Over 2004-2030, the cumulative value of aggregate MENA oil and gas export revenues would be more than a trillion dollars lower (in year-2004 prices) than in the Reference Scenario. The loss of revenues is almost five times more than the reduction in oil and gas investment. Revenues also fall in terms of net present value. Oil accounts for about 70% of the fall in revenues.

Consuming-Country Policies could Reduce MENA Export Demand

The World Alternative Policy Scenario depicts the energy future that might emerge if consuming-country governments press ahead with the vigorous new policy measures already being contemplated. They involve promoting more efficient energy use and switching away from fossil fuels, for environmental or energy-security reasons. The basic assumptions about macroeconomic conditions and population are the same as in the Reference Scenario. But energy prices change, because of the new level at which an equilibrium between supply and demand is established.

In the World Alternative Policy Scenario, global primary energy demand is about 10% lower in 2030 than in the Reference Scenario. Primary energy demand grows by 1.2% per year, 0.4 percentage points less than in the Reference Scenario. Nonetheless, demand in 2030 is still 37% above the current level. Oil remains the leading energy source. Its share of global primary energy demand – just over one-third – is only

slightly lower than in the Reference Scenario in 2030. By contrast, the share of coal in primary energy demand falls sharply in all regions. On the other hand, the use of non-hydro renewables, excluding biomass, is almost 30% higher in 2030 than in the Reference Scenario. Biomass and nuclear energy also grow. The effect of energy-efficiency and fuel-diversification policies on energy demand grows over the projection period, as the stock of energy capital goods is gradually replaced and new measures are introduced.

The fall in oil and gas demand in the main consuming regions leads to a reduction in MENA production and exports, and drives down prices. By 2030, MENA oil production reaches 45 mb/d – almost 6 mb/d less than in the Reference Scenario. But it is still more than 50% higher than in 2004. The oil price is on average about 15% lower compared with the Reference Scenario. Lower demand and prices cut cumulative MENA oil and gas export revenues by 21% over the projection period compared with the Reference Scenario. Revenues also fall in terms of net present value. Nonetheless, revenues in 2030 are $160 billion, or just over 50%, higher than in 2004.

Lower overall energy consumption and a larger share of less carbonintensive fuels in the primary energy mix yield a 5.8 gigatonne, or 16%, reduction in global carbon-dioxide emissions in 2030 compared to the Reference Scenario. This is comparable to the current combined emissions of the United States and Canada. 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 end-use efficiency policies. Emissions, nonetheless, still rise 28% over current levels.

Deepening the Consumer-Producer Dialogue would Bring Mutual Benefits

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 MENA upstream investment falters and prices rise, 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, 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.

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