



# The Oil Market to 2030—Implications for Investment and Policy

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## ABSTRACT

*Oil is (an important) part of a larger global energy market, which is expected to see continued consumption growth (largely in emerging markets) and a continued shift toward natural gas and renewable forms of energy. While oil continues to lose market share, overall consumption and production are likely to continue growing—though more slowly than they have in the past due to expected policy changes aimed at slowing oil's growth as well as the impact of higher prices seen in recent years. Consumption in OECD countries has likely peaked; the growth in global oil use will be entirely due to continued growth in emerging economies, most importantly China. Oil supply growth will be dominated by OPEC, although non-OPEC supply should continue rising modestly due to biofuels and other 'unconventional' supplies. This outlook suggests that the centers of gravity for both consumption and production will shift—to Asia for consumption and to Middle-East OPEC for production. Continued investment will be required for supply to meet expected demand growth; energy security will remain an important driver of policy (though U.S. import dependence should improve); and CO<sub>2</sub> emissions appear likely to continue rising. Market-oriented policies can help address the twin challenges of sustainability and security.*

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## ✎ INTRODUCTION ✎

The oil market outlook is not just a matter for energy companies: it's an issue for all of us. Will oil demand continue to grow? What are the prospects for other fuels to displace oil, especially in transportation? Will supply be able to keep up. . .and from where? What are the implications of these trends for climate change and energy security? And what are the opportunities for consumers, industry, and governments to impact these trends?

Around the world, there is a lively and important conversation taking place on the choices that face us all—as consumers, producers, investors and policy-makers. By sharing this outlook, based on BP's *Energy Outlook 2030*, we hope to contribute to that discussion. Our starting point in contributing to this debate has been BP's *Statistical Review of World Energy*, which this year celebrated its 60<sup>th</sup> anniversary.<sup>1</sup> We feel it is our responsibility as a company

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1. The BP Energy Outlook 2030 may be found at [www.bp.com/energyoutlook2030](http://www.bp.com/energyoutlook2030); the Statistical Review of World Energy may be found at [www.bp.com/statisticalreview](http://www.bp.com/statisticalreview).

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to make information and analysis available for public debate—all the more so if the issue at hand is as vital to all of us as is the oil market, including its relation to key issues such as energy security, economic development, and climate change.

### ✦ A BRIEF HISTORY ✦

Oil is the world's dominant fuel (at 33% of current global primary energy consumption), but it has been losing market share since the 1970s. The pace of oil's market share erosion mirrors the price cycle—oil lost share rapidly in the 1970s and early 1980s when prices were high; lost share slowly from the mid 1980s to the late 1990s when prices were low; and accelerated again when prices began to go up over the past decade. Oil has lost market share globally for 11 consecutive years, and oil's share of U.S. energy consumption is near the lowest levels ever recorded.<sup>2</sup> Demand has grown, but predominantly outside the OECD, with non-OECD countries accounting for 47% of global consumption, up from 25% in 1970 (OECD consumption has fallen by 3.6 Mb/d or 7% since 2005.). Sectorally, oil consumption is dominated by transport (more than 50% of global consumption and roughly 60% of OECD consumption); oil has lost significant market share in the power and industrial sectors. As with other fuels, demand and supply have been impacted over the years, primarily by the rate and distribution of global economic growth, but also by technological change (such as the emergence of nuclear power or advances in deepwater exploration, development, and production capability); competition from other fuels (cheap natural gas currently, especially in North America); and government policy (such as consumption taxes/subsidies, fuel efficiency standards, and resource nationalism).

On the supply side, OPEC holds a heavy majority (77%) of global proved reserves, but has not gained market share—indeed, OPEC's market share in 2010 (42%) was well below the 47% share seen in 1970 (OPEC's global share peaked at 51% in 1973). Outside of OPEC, production continues to increase despite mature declines in the North Sea, Mexico, parts of the U.S., and elsewhere: Output has grown in recent years in Russia and Central Asia; the deepwaters of the U.S. GoM, West Africa, and Brazil; and in the oil sands of Alberta. In addition, onshore production in the U.S. has begun to increase due to innovations in the development of shale resources (both oil and natural gas-related liquids); biofuels have been another key source of liquids supply growth (primarily the U.S. and Brazil—both enabled by rising oil prices in recent years with the U.S. also receiving a boost from tax credits and mandates).

Oil prices have increased in recent years, averaging about \$80 in 2010 and well above \$100 so far this year, which would be the highest (nominal) price on record. Oil prices have increased in absolute terms and relative to other fuels, with a record premium to natural gas prices in North America in 2010 (and so far this year). The oil market has been prone to disruptions, with major shocks to supply and prices in the early and late 1970s, 1990, and several times in the past decade. In response, both consuming- and producing countries have adopted strategies for dealing with unexpected outages, including the maintenance of spare capacity as well as investment in strategic stockpiles (which have recently been put to use).

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2. See U.S. Energy Information Administration (2010).

## ✎ BUILDING THE OUTLOOK ✎

Of course, the oil market outlook does not take place in a vacuum; oil is (an important) part of the global energy mix. To set the stage for the oil market discussion, it is therefore appropriate to briefly sketch out the broader global energy market outlook. The BP outlook seeks to identify long term energy trends based on the expected evolution of the world's population and economy, adding our best judgments of policy and technology to develop a projection for world energy markets to 2030. The outlook is a projection, not a proposition, and this is an important distinction. For example, our outlook expects global CO<sub>2</sub> emissions to continue rising, along with import dependence in many key consuming regions. This does not mean BP downplays the importance of climate change or the role of energy security in international relations. Rather, it reflects a 'to the best of our knowledge' assessment of the world's likely path from today's vantage point.

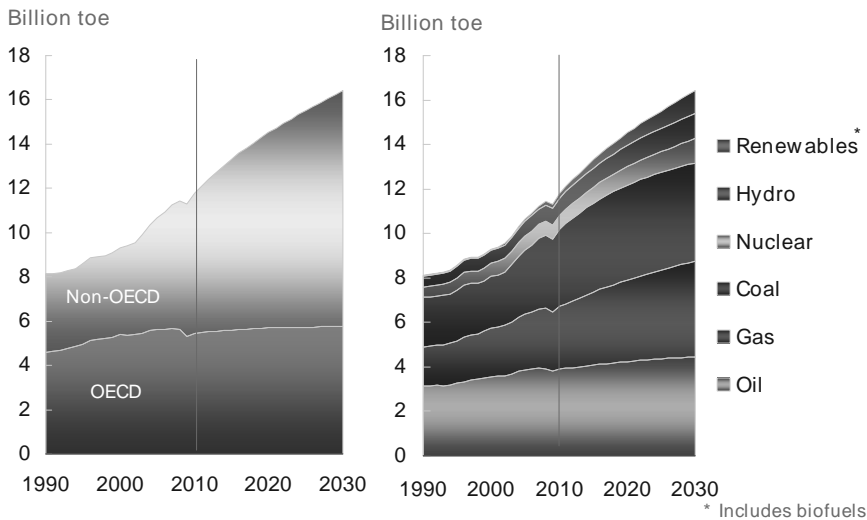
This outlook is not a 'business as usual' extrapolation, nor an attempt at modelling policy targets. Instead it is built 'to the best of our knowledge', reflecting our judgement of the most likely path for global energy markets to 2030. Assumptions on changes in policy, technology and the economy are based on extensive internal and external consultations. Key assumptions as they pertain to the oil market outlook will be discussed in the narrative to follow. In addition, a Policy Case (a fully built-up alternative case) is developed based on more aggressive policies to address climate change, assessing the impact of possible policy changes on energy consumption and production. We use this case—and other sensitivities—to explore the uncertainties of the Energy Outlook, a critical part of the exercise given the tremendous range of possible outcomes under any long-term forecasting exercise. We do not attempt to forecast long term energy prices as part of this Outlook.

- The outlook highlights the central role markets and well-designed policy can play to meet the dual challenges of solving the energy needs of billions of people who aspire to better lifestyles, as well as the opportunities and challenges of doing so in a way that is sustainable and secure.

Population and income growth are the two most powerful driving forces behind the demand for energy.<sup>3</sup> The next 20 years are likely to see continued global integration, and rapid growth of low- and medium-income economies. Population growth is slowing, but income growth is trending up: Over the last 20 years world population has increased by 1.6 billion people, and it is projected to rise by 1.4 billion over the next 20 years; the world's real income has risen by 87% over the past 20 years and it is likely to rise by 100% over the next 20 years. Energy consumption per capita to 2030 is likely to grow at about the same rate as in 1970–90 (0.7% p.a.), but energy intensity—measured very broadly as energy per unit of GDP—continues to improve globally, and at an accelerating rate. In 2010–30 this is expected to remain the case for the global average and for almost all of the key countries and regions. This expected continued acceleration in energy intensity improvement is important: It restrains the overall growth of primary energy. Energy intensity gains and a long-term structural shift away from industry and toward less energy intensive activities—first in rich and then in newly industrialized economies—underpin this trend.

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3. Population and GDP estimates are drawn, respectively, from the UN (2009) and Oxford Economics Ltd (2010).



**FIGURE 1**

Energy 2030: Non-OECD economies drive consumption growth

Another key factor is the resource base. Our work is based on an assessment of global proved reserves for oil, gas, and coal—those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.<sup>4</sup> While it is important to recognize that sovereign nations do not all apply the same standards in reporting proved reserves, the findings are generally consistent with other assessments of proved reserves, and the data clearly show that global proved reserves of fossil fuels are sufficient to meet expected consumption growth in the decades to come. For oil, world proved reserves at the end of 2010 stood at 1.38 trillion barrels—the highest figure on record (with data going back to 1980) and sufficient to meet current production for just over 46 years (for natural gas, that figure is 59 years, and for coal it is over 100 years). Estimates of oil proved reserves—both in barrel terms and expressed as a reserves/production ratio—have tended to grow over time as new discoveries and improved recovery rates have more than offset volumes produced. OPEC countries possess the heavy majority (77%) of global proved reserves, but both OPEC and non-OPEC proved reserves have tended to grow over time, with each increasing by about 25% over the past decade. We conclude that globally, resources are not likely to be a constraint for oil supply availability over the coming decades; above-ground considerations such as investment regimes, access policies, and industrial capacity are separately factored into the supply outlook discussed below.

#### ✦ KEY FINDINGS: REFERENCE CASE ✦

In our reference case (Figure 1), world primary energy consumption is expected to grow by 39% over the next 20 years, slightly slower than the 45% increase seen from 1990-2010. Global energy consumption growth is expected to average 1.7% p.a. from 2010 to 2030, with

4. See BP (2011a).

growth decelerating gently beyond 2020. The outlook for energy consumption growth is more rapid than the International Energy Agency's World Energy Outlook ("Existing Policies" scenario), driven by the continued rapid industrialization of developing economies; at the same time, switching to lower carbon fuels (from coal to gas, and from fossil fuels to renewables and nuclear) drives a slightly slower growth rate for CO<sub>2</sub> emissions.<sup>5</sup>

Non-OECD energy consumption is expected to be 68% higher by 2030, averaging 2.6% p.a. growth from 2010, and accounts for 93% of global energy growth. OECD energy consumption in 2030 is just 6% higher than today, with growth averaging 0.3% p.a. to 2030. From 2020, OECD energy consumption per capita is on a declining trend (−0.2% p.a.).

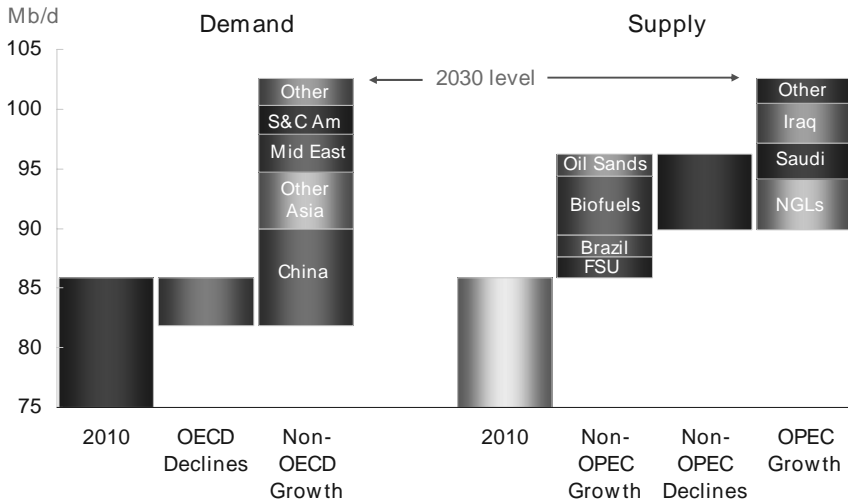
The fuel mix changes relatively slowly, due to long asset lifetimes, but gas and non-fossil fuels gain share at the expense of coal and oil. The fastest growing fuels are renewables (including biofuels) which are expected to grow at 8.2% p.a. 2010–30; among fossil fuels, natural gas grows the fastest (2.1% p.a.). The three fossil fuels are expected to converge on market shares of 26–27%, and the major non-fossil fuel groups on market shares of around 7% each. In our outlook, oil continues to suffer a long run decline in market share (falling from 46% of total energy consumption in 1970 to 39% in 1990 and 34% in 2010), while natural gas steadily gains. Coal's recent gains in market share, on the back of rapid industrialisation in China and India, are reversed by 2030. Taken together, the contribution of all non-fossil fuels to growth over the next twenty years (36%) is, for the first time, likely to be larger than that of any single fossil fuel. Renewables (including biofuels) account for 18% of the growth in energy to 2030. The rate at which renewables are expected to penetrate the global energy market is similar to the emergence of nuclear power in the 1970s and 1980s. Sectorally, power generation is the key driver of energy consumption, accounting for 57% of growth 2010–30, and raising its share of global energy consumption from 41% currently to 47% by 2030.

Oil (Figure 2) is expected to be the slowest-growing fuel over the next 20 years. Global liquids demand (oil, biofuels, and the other liquids conversion technologies) nonetheless is likely to rise by 16.5 Mb/d, exceeding 102 Mb/d by 2030. As is the case in the IEA outlook, consumption growth comes exclusively from rapidly-growing non-OECD economies. Consistent with our intention to develop a "most likely" outlook, our reference case global oil consumption growth rate is less rapid than the IEA's "Current Policies" Scenario and slightly more rapid than the "New Policies" Scenario. Non-OECD Asia accounts for more than three-quarters of the net global increase, rising by nearly 13 Mb/d. The Middle East and South & Central America will also grow significantly. OECD demand has likely peaked (in 2005), and consumption is expected to decline by just over 4 Mb/d by 2030.

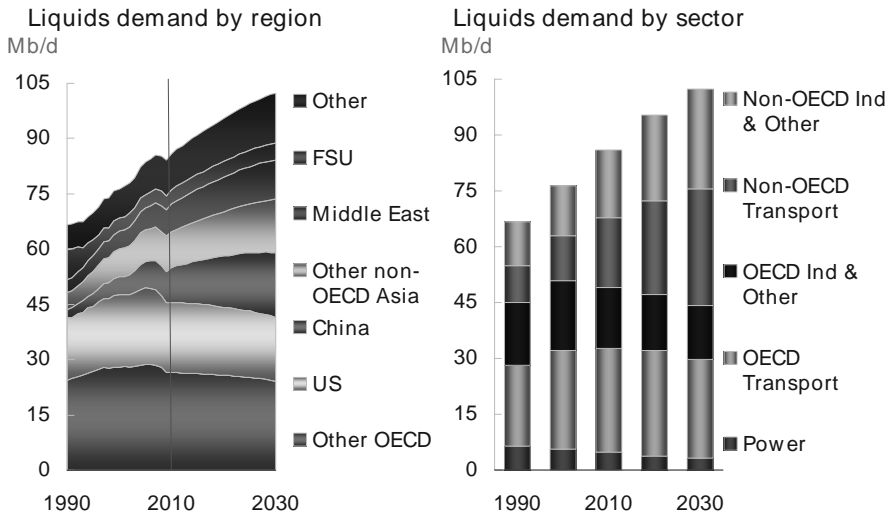
Rising supply to meet expected demand growth should come primarily from OPEC—again a conclusion broadly consistent with the IEA outlook—where output is projected to rise by 13 Mb/d. In essence, the growth in non-OECD Asian consumption will be met by OPEC supply. The largest increments of new OPEC supply will come from natural gas liquids (NGLs), as well as conventional crude in Iraq and Saudi Arabia. Non-OPEC supply will continue to rise, albeit modestly. A large increase in biofuels supply, along with smaller increments from Canadian oil sands, deepwater Brazil, and the FSU should offset continued declines in a number of mature provinces.

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5. The IEA stresses that none of the WEO scenarios should be viewed as forecasts; rather, they represent outcomes based on specific policy assumptions, with no assessment made on the likelihood of those policy assumptions. The BP outlook, by contrast, seeks to construct a "most likely" path, including judgments on future policy changes.



**FIGURE 2**  
The liquids supply-demand balance to 2030



**FIGURE 3**  
Demand growth driven by non-OECD transport and industry

### Oil Consumption

Overall oil consumption growth—or rather, total liquids consumption as described above—will be restrained by the increases in crude oil prices seen in recent years; the continued, gradual reduction of subsidies in non-OECD oil-importing countries; and new policies that seek to improve the efficiency of consumption, most notably in the transport sector. Global consumption growth in this outlook (Figure 3) is projected to slow to 0.9% p.a. (from 1.3% in 1990-2010); with other fuels growing more rapidly, oil continues to lose market share to other fuels & is matched by coal around 2015, and by natural gas around 2030.

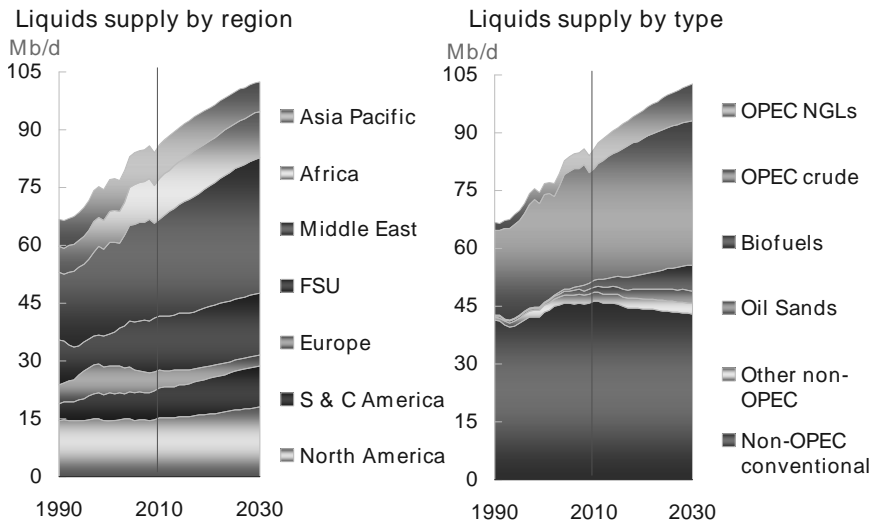
OECD consumption will fall to 41.5 Mb/d, roughly the 1990 level. Non-OECD consumption is projected to overtake the OECD by 2015, and to approach 61 Mb/d by 2030—more than double the 1990 level. However, excluding the FSU (where demand collapsed along with the economies of the Former Soviet republics in the 1990s) non-OECD growth is likely to be slower than 1990-2010 (2.2% vs 3.8% p.a.). With rapid growth of biofuels (discussed below), the oil portion of liquid fuels demand is expected to grow even less rapidly, by 0.6% p.a.

Under our outlook, OECD consumption has already peaked—it most likely will never again reach the level seen in 2005. Consumption will be impacted by a combination of economic maturity, consumer reactions to the higher oil prices seen in recent years, and additional policies aimed at reducing consumption—motivated by a combination of revenue requirements, energy security concerns and a desire to reduce CO<sub>2</sub> emissions. For example, we expect both new fuel taxes and greater fuel efficiency standards for vehicles in the OECD countries. With natural gas currently priced competitively, we also see some displacement of oil by gas in power generation, industrial applications, and residential/commercial use.

By sector, liquids demand growth should come from non-OECD transport (nearly 13 Mb/d), with non-OECD industry also contributing (nearly 7 Mb/d, largely for petrochemicals). Price impacts in these cases are outweighed by continued rapid economic growth, although the continued removal of subsidies in many non-OECD oil-importing countries will begin to weigh on consumption patterns, as will policies aimed at improving fuel efficiency (such as the targets already adopted in China). Expected OECD declines are concentrated outside the transport sector, in sectors where oil can be displaced by gas and renewables; post-2015, OECD transport demand is also expected to fall as technology and policy lead to improved engine efficiency and more efficient vehicles begin to enter the fleet.

Energy used for transport will continue to be dominated by oil, but the transport sector should see its share of global energy use decline as other sectors grow more rapidly. Growth of energy consumption in the transport sector is expected to slow over the next twenty years to average 1.1% p.a. vs 1.8% p.a. during 1990-2010, with OECD demand slowing and then declining post-2015. The slowing of growth in total energy in transport is related to higher oil prices and improving fuel economy, vehicle saturation in mature economies, and expected increases in taxation and subsidy reduction in developing economies. The growth of oil in transport slows even more dramatically, largely because of displacement of oil by biofuels, and is likely to plateau in the mid-2020s. Currently, biofuels contribute 3% on an energy equivalent basis and this is forecast to rise to 9% at the expense of oil's share. Rail, electric vehicles and plug-in hybrids, along with compressed natural gas in transport, are likely to grow, in part due to policy support. But the cost of these options (including batteries and/or refuelling infrastructure) combined with the long economic lives of the existing transportation stock mean that these alternatives are unlikely to make a material contribution to total transport-sector energy consumption before 2030.

China is the largest source of oil consumption growth in our outlook, with consumption forecast to grow by 8 Mb/d to reach 17.5 Mb/d by 2030, overtaking the U.S. to become the world's largest oil consumer. Growth is expected to remain concentrated in the industrial and transport sectors through 2020. Industrial growth slows post-2020 as industrial expansion becomes less energy-intensive and population growth slows; transport will then be the dominant growth driver. Despite contributing almost half of net global oil consumption growth to 2030, our outlook projects a slower increase in Chinese per capita consumption than seen



**FIGURE 4**

Supply growth comes primarily from OPEC

historically in other Asian economies. China is much less dependent on oil in its overall fuel mix (18% in 2010) than many other emerging economies at similar points in their development. In addition, China is likely to implement policies to slow oil consumption growth—such as modestly increasing taxes on transport fuels, raising vehicle efficiency standards, and maximising use of other fuels. Finally, oil prices are higher than faced historically by other emerging economies; and rising import dependence is a policy concern.

### Oil Production

Globally, liquids production of course is expected to increase to meet the growth in consumption, though the sources of growth will change the global balance. As is the case for consumption, global liquids supply is set to rise by about 16.5 Mb/d by 2030 (Figure 4). OPEC accounts for over 75% of global supply growth in our outlook, with OPEC NGLs expected to grow by more than 4 Mb/d—the largest increment to OPEC supply in our outlook—driven in part by rapid growth of natural gas production in our outlook. Iraqi crude output is projected to grow from about 2.5 Mb/d currently to more than 5.5 Mb/d; Saudi output is likely to expand by nearly 3 Mb/d.

Non-OPEC output will rise by nearly 4 Mb/d. Unconventional supply growth should more than offset declining conventional output, with biofuels adding nearly 5 Mb/d and Canadian oil sands rising by nearly 2 Mb/d. Declining conventional crude supply in Europe, Asia Pacific and North America is partly offset by growth in deepwater Brazil and the FSU, resulting in a net decline of just over 3 Mb/d. In this outlook, Russia and Saudi Arabia will each sustain their current market share of roughly 12% over the next 20 years.

Biofuels production (largely ethanol) is expected to exceed 6.5 Mb/d by 2030, up from 1.8 Mb/d in 2010—contributing 30% of global supply growth over the next 20 years, and all of the net growth in non-OPEC supply. Continued policy support, high oil prices in recent years, and technological innovations all contribute to the rapid expansion. The U.S. and Brazil will continue to dominate production; together they account for 68% of total output in 2030



(down from 76% in 2010). First-generation biofuels are expected to account for most of the growth, with improved yields helping to avoid pressure on the world food system. After 2020, roughly 40% of global liquids demand growth will be met by biofuels—up from 13% in 2010—with the U.S. and Europe leading consumption growth. By 2030, this figure approaches 60%.

The importance of OPEC is expected to grow. On our projections, OPEC's share of global production would increase from 42% in 2010 to 46% in 2030 (a level not reached since 1977). In the early years of the outlook, OPEC production growth can be met by utilizing current spare capacity.<sup>6</sup> Over time, production capacity must expand to meet expected demand growth. In addition to growth in NGLs production, we project an increase in crude oil production capacity of nearly 5 Mb/d by 2030—to nearly 40 Mb/d—largely in Iraq and Saudi Arabia. Prospects for growth in other OPEC countries are conservative, partly due to the expectation that investment regimes in many countries will remain restrictive. These projections imply that Saudi production capacity, currently at 12.5 Mb/d, is likely to be sufficient to meet demand and maintain a reasonable buffer of spare capacity until around 2020; thereafter a modest expansion appears likely. While we do not attempt to forecast long-term energy prices, the ability and willingness of OPEC members to expand capacity and production clearly is one of the main factors determining the path of the oil market.

The pace of Iraqi capacity expansion—and production growth—is another key source of uncertainty for this outlook. Iraq is expected to account for 20% of global supply growth from 2010 to 2030. Service contracts awarded since mid-2009 have signaled the notional (contractual) possibility that Iraqi capacity could reach 12 Mb/d by 2020. However, limited project development capacity and infrastructure constraints may result in project delays and cost inflation. Key challenges exist in developing export pipelines, terminals and water injection infrastructure. Security challenges, as well as political constraints, are also likely to weigh on capacity expansion plans. A rapid increase in Iraqi output could have an impact on oil prices, and OPEC is likely over time to seek to reintegrate Iraq into the quota system, which is an additional source of uncertainty. While substantial capacity growth is likely, a number of factors should constrain the pace of expansion. Weighing these factors, we assume Iraqi production exceeds 4.5 Mb/d by 2020 and 5.5 Mb/d by 2030, but the range of possible outcomes is large.

Growth in the call on refinery throughput will be impacted by the supply growth of biofuels (5 Mb/d) and non-refined NGLs (2 Mb/d). Increases in processing gains and growth in supplies of liquids derived from gas and coal are likely to add another 1 Mb/d to product supplies that do not require refining. All of these supply sources will compete directly with refineries to meet total liquids demand growth of 17 Mb/d, suggesting that the call on refinery throughput could grow by only 9 Mb/d over the next 20 years. Existing spare capacity will accommodate some of the future growth in refinery throughput. Moreover, about half of global liquids demand growth is expected to be in China, and that country's refinery expansion plans will affect product balances globally. A continuation of China's strategy to be self-sufficient in refined products would severely limit crude run increases for refiners outside of China.

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6. This outlook was prepared in early 2011, before the disruption of Libyan oil exports. The extended loss of Libyan production would have adverse implications for the buffer of spare capacity assumed in this outlook. We have not yet assessed the implications of widespread unrest in the region for the pace of investment in production capacity, price objectives, or attitudes toward private investment.

## ✎ KEY FINDINGS: POLICY CASE AND SENSITIVITIES ✎

Our Policy Case explores the implications of more aggressive policies to address climate change. We assume that a wide range of policy tools are deployed, including putting a price on carbon (particularly in OECD countries). Richer countries achieve significant cuts in carbon emissions, while developing countries focus on reducing the carbon intensity of their economies. In this case, global CO<sub>2</sub> emissions would peak just after 2020 and be 14% lower than the Base Case by 2030, but still 21% above 2005 levels. The emission reduction is achieved through a combination of more rapid efficiency gains and switching to lower carbon fuels. Oil consumption by 2030 is 5% below the base case; natural gas consumption is reduced by 4%, while coal use is reduced by 23%. There is limited scope for fuel switching in transport, although electric vehicles start to make an impact by 2030, so the main effect here comes through greater vehicle efficiency. The greatest scope for fuel switching is in power generation, where renewables are the big winner (up 33% versus the base case in 2030) and coal the big loser. Globally, natural gas gains share even as it loses volume overall.

The oil market path in the Policy Case will depend crucially on the degree of OPEC's accommodation of lower demand to manage prices. Based on historical experience, we assume that OPEC members reduce output to match only a portion—not the entire—decline in consumption, resulting in prices that are lower than our reference case (but not as low as they would have been with no OPEC response). As with other fuels, lower oil prices (because of lower demand) partly counteract the initial demand response to stricter policies. Netting out these feedback effects, global liquids demand is expected to reach just 97.5 Mb/d (+0.6% p.a.) in 2030—5 Mb/d below the base case. Consumption declines are likely to be concentrated in the OECD (with the most aggressive policies) and the Middle East and FSU (where oil intensity is highest). Again, the reaction of OPEC producers to sharply lower demand would be a key driver of the price path in such a scenario.

Recognizing the large range of uncertainty that comes with any long-term forecasting exercise, we further examine the sensitivity of energy—including oil—demand to alternative paths for economic growth. A high-growth case takes an optimistic view on globalisation: expanding international trade flows would support widely-shared long-run growth in productivity and incomes. Adding 0.9% to the long-run growth rate leaves global GDP in 2030 18% higher than in the base case. With income elasticity of energy demand being less than one, and holding all other factors equal, total energy demand would be 11% higher than in the base case, and oil consumption—being slightly more sensitive to changes in GDP than energy overall—would be 13% higher. The low GDP growth case assumes that protectionism and other interventions reduce long-run trend growth rates. This cuts one percentage point from the long-run growth rate, leaving global GDP 18% below the base case level; energy demand would be 13% lower than the base case, and oil consumption would be 14% lower.

## ✎ IMPLICATIONS . . . ✎

### . . . for Investment

Even though oil is expected to lose global market share to other forms of energy in this outlook, consumption is still expected to grow significantly. Accordingly, producers will be required to make substantial investments to increase output—in addition to the very large investments needed merely to offset decline rates. While resources are not constrained globally,

this outlook suggests that national policies governing access and investment terms have the potential to significantly impact the trajectory of production (and therefore prices); clearly, the investment decisions of OPEC members—with 77% of current global proved oil reserves—will be critical. Given the measured pace of investment expected in this outlook among many OPEC countries, prospects for development of higher-cost resources elsewhere appear likely to remain attractive. Given the preponderance of proved reserves under their control (or influence), the role of National Oil Companies appears likely to continue growing in importance; consuming country NOCs offering access to rapidly-growing markets also appear likely to increase their influence.

For refining, investment prospects appear likely to remain challenging, due to the combination of modest growth in global consumption—and declining consumption in mature OECD markets—combined with robust growth from liquids that are not refined, such as biofuels and non-refined NGLs.

### **. . . for CO<sub>2</sub> Emissions**

In our reference case, global CO<sub>2</sub> emissions from energy consumption continue growing through 2030, driven by strong growth in non-OECD energy consumption, especially of coal. The growth of global CO<sub>2</sub> emissions from energy averages 1.2% p.a. over the next twenty years (compared to 1.9% p.a. 1990–2010), leaving emissions in 2030 27% higher than today. CO<sub>2</sub> emissions from oil consumption rise by about 14%, with all of the increase coming from non-OECD countries; OECD emissions from oil consumption decline in both the reference and policy cases. With oil losing market share to other fuels, oil's share of global CO<sub>2</sub> emissions falls from about 37% currently to about 33% by 2030. Under a more aggressive climate policy case, global CO<sub>2</sub> emissions from energy consumption—and for oil—begin to decline, though the level of CO<sub>2</sub> emissions from energy use by 2030 remain above 2010 levels. Clearly the trajectory of energy consumption and CO<sub>2</sub> emissions will depend on the outlook for economic growth. Also clearly, the robust availability of global proved reserves of oil and other fossil fuels means that growth of CO<sub>2</sub> emissions is unlikely to be constrained by resource availability over the next 20 years (although, as discussed earlier, above-ground considerations will significantly impact the development of future production capacity).

### **. . . for Import Dependence**

There are some positive implications under the reference case outlook. While global dependence on OPEC supply rises as discussed above, U.S. import dependence—in both volume and percentage terms—falls to levels not seen since the 1980s, due falling consumption and rising domestic production of ethanol and shale-related liquids, which displace oil imports. In contrast, import dependence for the EU and China rises. In the EU, import dependence in percentage terms continues rising as domestic production falls, although import volumes decline in the face of rapid declines in consumption. In China—which was a net oil exporter in the early 1990s—import dependence rises significantly, from just over 50% currently to nearly 80%.

In the more aggressive policy case, import dependence in the U.S. and EU falls relative to the reference case due to reductions in consumption of roughly 1 million b/d and 700 kb/d, respectively, by 2030—in each case about 6% of reference case oil consumption. (Chinese oil consumption in the policy case is not significantly impacted.)

## ✦ CONCLUSIONS ✦

Oil consumption appears likely to continue growing, driven by rapidly-growing emerging economies and despite the likelihood that OECD consumption has peaked. That said, oil is likely to grow less rapidly than other fuels, due to a combination of consumer reactions to higher prices and government policies aimed at slowing oil's growth. Global resources are adequate to meet the expected growth in consumption, but the policies of countries that own the majority of the resources are likely to constrain the pace of development, leaving high-cost supply options viable. Oil (and biofuels) will likely remain dominant in the transport sector to 2030, with cost and the long economic lives of oil-consuming equipment limiting prospects for other fuels to win substantial market share over the next 20 years.

Policy choices made by governments matter. For supply, policy will govern the ability of investment (whether by NOCs or private companies) to access prospective resources, as well as the incentives to develop alternatives such as biofuels. For demand, policies appear likely to slow consumption growth (whether motivated by concerns for climate, security, or budgets). Budget constraints may challenge subsidies (for consumption in many emerging economies and for biofuels and other renewables in mature OECD economies).

Markets matter as well. Consumers and producers alike clearly respond to price signals where they are able to do so. Production is rising in U.S. on the back of a rapid increase in drilling—and technological innovation—motivated by higher prices. Consumption in the OECD countries was declining even before the recession due to higher prices. Shifting relative prices between fuels is driving changes to both the supply and demand picture. However, there are critical areas where policy and markets are not (yet) connected, such as CO<sub>2</sub> emissions from energy use—a classic example of an externality. And unfortunately there are also many instances of government policy hindering the ability of market participants to respond to price signals—such as subsidy regimes that shield consumers from recent price increases, and restrictions on access to resources in many countries. Those interested in sustainable and secure oil market solutions should give greater weight to policies aimed at expanding, rather than constraining, the reach of—appropriately designed and overseen—market forces.

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