

Executive summary

Price assumption in the Reference Case: \$85–95/b for this decade

This year's World Oil Outlook (WOO) sees a revision to last year's nominal OPEC Reference Basket price assumption in the Reference Case due to: the behaviour of prices since the publication of the WOO 2010; a slight reassessment of how upstream costs might evolve; the impact of dollar exchange rate movements on recent prices and potential future developments; and signals from the futures price. It is important to note, however, that the role of speculation has continued to be a major price driver in 2011, with speculator activity on the Nymex surging to record highs in the first quarter of 2011. As such, the most recent price behaviour should not directly feed into assumptions for prices over the medium- and long-term. The WOO 2011 Reference Case oil price assumption has been increased from last year. It is assumed that, in nominal terms, prices stay in the range of \$85–95/b for this decade, compared to \$75–85/b in last year's WOO, reaching \$133/b by 2035. Last year, the timeframe was to 2030 and it was assumed that prices rose to \$106/b. It should be emphasized, however, that these figures are only an assumption. They do not reflect, in any way, a projection of likely or desirable prices.

Marginal costs are important in making long-term price assumptions

It is generally accepted that long-term oil price assumptions should involve an assessment of marginal costs. It is evident that the WOO 2010 nominal price assumption may be too low. For example, coal-to-liquids (CTLs) backstop prices could be in the range of \$74–85/b, and the price needed to support Canadian oil sands projects at internal rates of return above 10% suggest higher prices than previously assumed. Cost curves also show that at high prices, vast amounts of non-conventional oil would be economic.

Stronger recovery from the Great Recession in 2010 than expected...

A major change from last year's report is the more rapid recovery from the Great Recession than was assumed in the WOO 2010, with global growth in 2010 now estimated to have been 4.6%, compared to the 3.9% assumed last year. Medium-term economic growth rates are largely unchanged from the previous WOO's assumptions. Average global growth over the period 2010–2015 is 3.9% per annum (p.a.). The recovery has been driven by stimulus packages and monetary policy, as well as the fact that developing countries have been a major factor supporting global economic growth, and this is assumed to continue to be the case over the medium-term.

...but the global economic recovery continues to be fragile

However, the global economic recovery is increasingly showing signs of weakness. Two developments seem possible from here. The first is that the global economy will be marked by below average trend growth, in combination with high unemployment in developed economies and continuing global growth imbalances. And

the second is the potential failure of the current support schemes and mechanisms, which would shock the global economy and push it back into decline. At present, this seems the less likely scenario, but it cannot be ruled out altogether. There are three main areas of concern. The first, and most pressing issue, are the widening deficits and ballooning sovereign debts in euro-zone countries. If not cooperatively managed, and resolved in a timely manner, they could lead to a worrisome banking crisis with potentially damaging systemic risk. The second major issue relates to the US economy. Of significant concern is the relatively muted recovery in private household demand. After the economic crisis of 2008 and 2009, a revival in consumer consumption was greatly supported by government-led stimulus. However, the economic recovery has recently decelerated considerably after the fiscal stimulus and the major ‘extraordinary’ monetary supply measures came to an end. The third major issue is the recent slow-down, albeit moderate, in developing countries, particularly the deceleration in China and India whose economies remain largely dependent on either capital inflows from, or exports to, developed countries. Recent significant increases in inflation have forced the countries to make provisions to avoid their economies overheating. The question remains as to whether this represents a well-managed soft landing or the early indication of future economic difficulties. In summary, given that stimulus packages and monetary policy have been the main driving force behind the recovery since the financial crisis began in 2007, the recovery cannot be deemed to be self-sustaining. Medium-term prospects will depend on the ability of governments to maintain their various support measures for as long as it takes to solve their economic issues.

Demographic trends are a determinant of future energy patterns

Demographic trends are important for determining long-term economic growth potential and energy demand. This year’s extension of the WOO’s timeframe to 2035 means that the impacts of population dynamics are even more pronounced. There will be a slowing of population growth, or even a contraction in some regions, and other demographic features are now being observed, such as rising urbanization and a generally ageing population. The world population increases from just over 6.9 billion in 2010 to almost 8.6 billion in 2035. Only 110 million of the increase over the period 2010–2035 is in the Organisation for Economic Co-operation and Development (OECD) countries, while close to 1.6 billion more people will be living in developing countries.

Reference Case only includes policies that are already passed into law

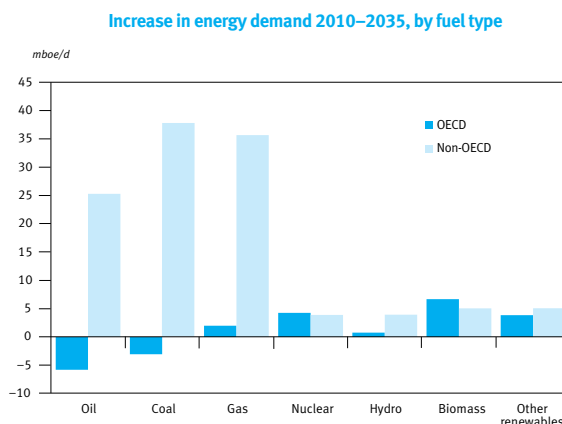
The Reference Case retains the principle that only policies already in place or widely anticipated are allowed to influence supply and demand patterns. The two key policies already factored in are the European Union (EU) package of measures for climate change and renewable objectives and the US Energy Independence and Security Act.

China's latest Five Year Plan: a consolidation of previous ones?

China's recently announced 12th Five Year Plan for the period 2011–2015 includes a focus upon increasing energy efficiency, decreasing carbon intensities, reducing the share of fossil fuels in the energy mix, pushing battery cell technology development, as well as sustaining economic growth at an average of 7% p.a. over the next five years. The Plan contains an energy consumption target of no more than 2,800 million tonnes of oil equivalent p.a. by 2015. This is a challenging target considering that it is only 8.5% above 2010 levels. In the previous five-year period, China's energy consumption actually increased by around 39%. A new carbon intensity reduction concept is also included; in terms of CO₂ emissions per unit of gross domestic product, the Plan states that the country will look to reduce this by 17% by 2015 compared to 2010 levels.

Energy demand increases by 51% by 2035

Over the period 2010–2035, commercial primary energy demand in the Reference Case increases by 51%. Fossil fuels, currently accounting for 87% of primary commercial energy supply, will still make up 82% of the global total by 2035. For most of the projection period, oil will remain the energy type with the largest share. However, by 2035 it will have been overtaken by coal use in the Reference Case, which will represent 29% of total energy, similar to today, while oil's share falls from 34% to 28%. Gas use will rise at faster rates than both coal or oil, in percentage terms and volumes, with its overall share rising from 23% to 25%.



Nuclear prospects affected by Fukushima

The prospects for nuclear energy have clearly been affected by this year's devastating accident at the Fukushima nuclear plant in Japan. The Reference Case reflects the immediate aftermath of the nuclear accident, when shut-in nuclear power was replaced by other fuels. Moreover, moving forward, it is assumed that the long-term prospects for nuclear power have been negatively affected. Possible adverse impacts can be expected elsewhere too. In the Reference Case, nuclear energy still expands at an average rate of 1.7% p.a., although its long-term contribution has been slightly

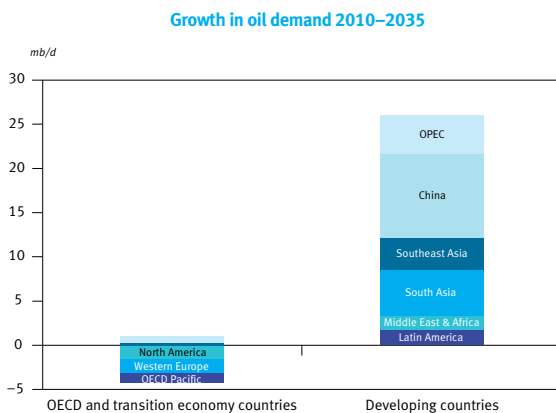
revised down, by under 0.5 million barrels of oil equivalent per day (mboe/d), from estimates in last year's WOO.

Medium-term oil demand up to 93 mb/d by 2015

In terms of oil demand, the Great Recession had enormous implications for projections in both the short- and medium-term. However, with the initial recovery swifter than expected, although risks now appear rather skewed towards the downside given the widening global macroeconomic uncertainties, the medium-term oil demand outlook reflects an upward revision from last year's assessment. The Reference Case now foresees demand reaching 92.9 mb/d by 2015, an upward revision of 1.9 mb/d.

Oil demand reaches 110 mb/d by 2035

While the central driver for medium-term oil demand is the economy, in the long-term other important drivers come in to play. The impact of policies, technologies, demographics and, to a lesser extent, oil price developments, will increasingly influence long-term demand patterns. In the Reference Case, demand increases by close to 23 mb/d over the period 2010–2035, reaching almost 110 mb/d by 2035. OECD demand actually seems to have peaked in 2005, and the Reference Case sees a steady demand decline in all OECD regions. Fully 80% of the increase in global demand is in developing Asia, where demand reaches almost 90% of that in the OECD by 2035.



World oil demand outlook in the Reference Case

mb/d

	2010	2015	2020	2035
OECD	46.1	46.0	45.2	41.9
Developing countries	35.9	41.8	47.2	61.9
Transition economies	4.8	5.1	5.3	5.9
World	86.8	92.9	97.8	109.7

Transportation sector key to future oil demand growth

Transportation in non-OECD countries is central to future global demand growth, accounting for close to 90% of the increase over the period to 2035. Developing countries are also expected to see some rise in oil use in other sectors, particularly in industry and the household/commercial/agriculture sector. Globally, the small amount of oil that is still used for electricity generation is expected to fall. In OECD countries, the declining use of oil is dominated by the demand fall in road transportation, as vehicle fuel economies improve and the rate of increase for car ownership slows.

Transportation technology: a major source of efficiency gains

Conventional powertrain technology is expected to continue to act as a source of substantial future efficiency gains. This is true for diesel engines and probably even more for gasoline engines. Hybrid and plug-in vehicles will also begin to have an impact on the vehicle sales mix. In these areas, however, technology and infrastructure are still in their infancy and customer habits will need time to change. With regard to heavy-duty vehicles, the focus is turning to fuel consumption targets, with Japan leading the way, although steps towards implementing fuel efficiency standards in other markets are gradually emerging. Alternative technologies, especially hybrids, are expected to face some commercial and technical challenges in this heavy-duty vehicle segment. Conventional technology improvements and the take-up of new powertrain technologies are therefore anticipated to affect the average fuel consumption for all vehicles. The effects will be lower for trucks than for passenger cars, due to lower levels of hybridization, limited opportunities for plug-ins and constraints to improvements in mainstream diesel engine technology.

Non-OPEC and OPEC supply rise over the medium-term...

Total non-OPEC supply increases steadily over the medium-term, rising by 3 mb/d over the period 2010–2015. The key drivers of this growth are the Caspian region, Brazil and Canada. Biofuels, mainly in Europe and the US, also make some

World oil supply outlook in the Reference Case

mb/d

	2010	2015	2020	2035
OECD	19.9	20.3	20.4	22.2
Developing countries, excl. OPEC	16.9	18.4	19.4	19.3
Transition economies	13.4	14.3	14.9	16.1
Total non-OPEC	52.3	55.3	57.3	60.5
OPEC NGLs	4.8	6.2	7.2	9.4
OPEC GTLs	0.1	0.3	0.4	0.6
OPEC crude	29.3	31.3	33.2	39.3

contribution. These supply increases more than compensate for expected conventional oil declines in North America and the North Sea. An increase in OPEC natural gas liquids (NGLs) is also expected over the medium-term, rising from 4.8 mb/d in 2010 to more than 6 mb/d in 2015. The required amount of OPEC crude will rise gradually, from 29.3 mb/d in 2010 to just over 31 mb/d by 2015.

...and long-term too, driven by more non-conventional oil

Over the long-term, increases in conventional oil supply from the Caspian and Brazil, as well as steady increases in non-conventional oil, mainly from biofuels, oil sands and shale oil, will more than compensate for expected decreases in mature regions. Total non-OPEC non-conventional oil supply thereby rises by more than 11 mb/d over the years 2010–2035. On top of this, total NGLs supply,

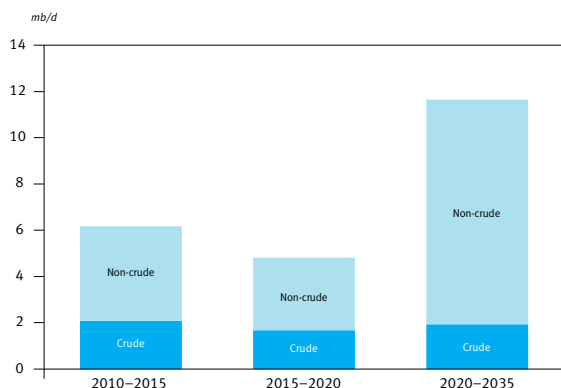
from OPEC and non-OPEC, increases by 6 mb/d over the same period, from 10.5 mb/d in 2010 to almost 17 mb/d by 2035. The total increase of non-crude liquids supply will satisfy more than three quarters of the demand increase to 2035. Crude supply in the Reference Case only increases to 74 mb/d by 2025, and then stops rising. There is then no need for additional crude supply. Finally, OPEC crude supply in the Reference Case rises

throughout the period to 2035, reaching just over 39 mb/d by 2035, including additional supply necessary for stocks. The share of OPEC crude in total supply by 2035 is 36%, not markedly different from current levels.

Scenarios underscore feasible alternatives to Reference Case

Beyond the Reference Case, it is important to explore developments that could feasibly emerge under realistic alternative assumptions to the drivers of supply and demand. Indeed, the question arises whether the Reference Case is a ‘most-likely’ scenario. In reality, it is not to be interpreted as such: it is essentially a ‘dynamics-as-usual’ world, but these dynamics are clearly subject to a variety of influences and bring with them a wide range of potential qualitative and quantitative impacts on supply and demand. These influences include technologies, particularly in transportation, policies, the environment and what evolves to combat the threat of climate change and perceived concerns over energy security.

Incremental crude and non-crude oil supply in the Reference Case



The Alternative Transportation Technologies and Policies scenario

An Accelerated Transportation Technology and Policy (ATTP) scenario has been developed. This assumes higher efficiency improvements to internal combustion engines; an accelerated shift to hybrids, and in some parts of the world, electric vehicles; a more rapid penetration in some regions of natural gas in the transportation sector; and an accelerated move to regulate efficiencies in commercial vehicles. It also includes a more aggressive support for alternative fuels, in particular biofuels, CTLs, biomass-to-liquids, gas-to-liquids and compressed natural gas and the assumption that international marine bunker regulations lead to more efficient fuel use in this sector.

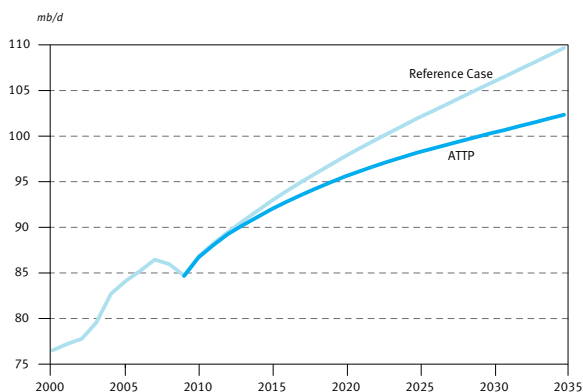
Major impacts on OPEC investment requirements in ATTP scenario

In the ATTP Scenario, more than 7 mb/d is removed from global oil use by 2035, when volumes reach around 102 mb/d. Non-OPEC supply is 3 mb/d higher by 2035, compared to the Reference Case. Consequently, the call on OPEC crude by 2035 is a reduction of more than 10 mb/d when set alongside the Reference Case. Thus, in the ATTP scenario, there will

effectively be little room for additional future OPEC crude supply. Indeed, by 2035, the amount of OPEC crude needed will be less than current levels. This means that OPEC upstream investment requirements are subject to huge uncertainties. While the Reference Case in 2025 sees upstream investment requirements of \$480 billion (2010 prices), the ATTP scenario points to requirements of just \$290 billion. This demonstrates the genuine concerns

over security of demand. These estimates do not include investments required in the mid- and downstream industries of OPEC Member Countries.

World oil demand in the ATTP scenario



Future economic growth: important implications for oil demand

A further scenario in the WOO examines the global economy, documenting how uncertainties over economic growth, in the short-, medium- and long-term, have very important implications for the evolution of oil demand. This further complicates the challenge of making appropriate investment decisions along the oil supply chain. Uncertainties over economic growth have been brought to the fore by the recent Great Recession. Looking ahead, countries burdened by heavy government debt will be

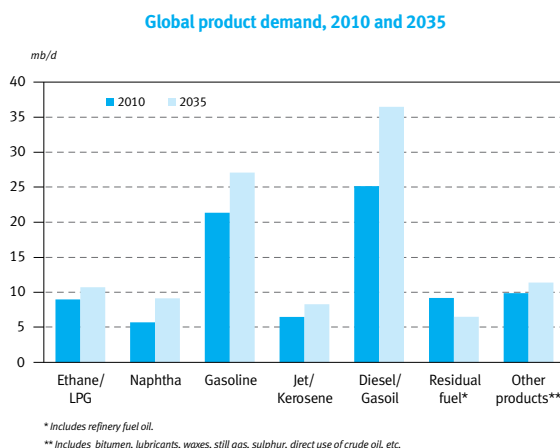
hampered in their growth prospects if fiscal consolidation is not properly managed. In addition, there are increasingly longer term questions being raised over economic growth rates in the face of a possible retreat of globalization. However, economic growth uncertainties could also point to upside potential as, for example, emerging markets are not as financially constrained as major OECD regions and may increasingly become the motor of world growth.

Higher and lower growth have major impacts upon demand for OPEC crude

Scenarios have been developed with both higher and lower economic growth rates of 0.5% p.a. In the lower growth scenario, oil demand by 2035 reaches slightly over 100 mb/d, or about 9 mb/d lower than in the Reference Case. Because of slightly softer oil prices, non-OPEC oil supply is about 2 mb/d lower than in the Reference Case by 2035. This means that the call on OPEC crude oil by 2035 is 7 mb/d lower than in the Reference Case. In this scenario, OPEC crude oil rises slowly, to around 32 mb/d by the mid-2020s, where it stays approximately constant. In the higher economic growth scenario, global oil demand inevitably rises more swiftly, to reach over 112 mb/d by 2030 and almost 119 mb/d by 2035. This further demonstrates the uncertainty over future oil demand due to economic growth, from both the upside and downside. Economic growth uncertainties are therefore probably at least as big a concern with regards to security of demand as the development of policies and technologies, especially over the short- to medium-term.

Middle distillates and light products will dominate product demand growth

Growth in the road transport sector, which is steering demand for gasoline and diesel, is projected to sustain the gasoline-diesel imbalance that has emerged in the past decade. This is clearly evident in the fact that, out of 23 mb/d of additional demand by 2035 compared to the 2010 level, around 57% is for middle distillates and another 40% is for gasoline and naphtha. For the remaining products, a decline in residual fuel is broadly offset by an increase in ethane/LPG and the group of 'other products'. A consequence of these demand trends is a progressive change in the make-up of the future product demand slate. Middle distillates will not only record the biggest volume



increase, they will also raise their share in the overall slate from the current 36%, to 41% by 2035.

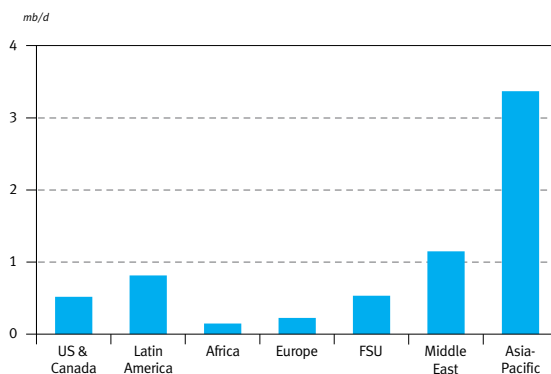
New regulations will further impact demand growth for diesel oil and gasoline

This year's WOO incorporates two new regulations that impact demand growth trends for both diesel oil and gasoline. The first is the European Commission's proposal for Council Directive amending Directive 2003/96/EC to change the taxation policy for refined products (including biofuels), which can be viewed as a signal to EU member states to reverse unwarranted tax advantages for diesel and to steer long-term demand patterns in a balanced and sustainable manner for the refining industry. The second, and the more important, is the adoption of more stringent regulations for marine bunkers by the International Maritime Organization (IMO). While the long-term effect of the first factor will mean a reduction in gasoil/diesel and an increase in gasoline demand over time, the expected effect of the IMO regulations more than offsets the diesel reduction, and leads to a net increase for this product.

New refining capacity moves to developing countries

Recent assessments indicate that around 6.8 mb/d of new crude distillation capacity will be added to the global refining system in the period to 2015. The highest portion of this new capacity is expected to materialize in the Asia-Pacific region, mainly in China and India, accounting for 50% of additional capacity, or 3.4 mb/d. While investments in refining capacity in the Asia-Pacific are predominantly driven by domestic demand, in the other two regions with the highest capacity additions to 2015, the Middle East and Latin America, the incentive is a combination of local demand and, given their increasing supplies of domestic heavier crude streams, the 'value added' benefits of refining 'at home'. Of the global 6.8 mb/d of new refining capacity by 2015, the world's developing regions will account for almost 5.5 mb/d. The scale of new refining capacity in developing countries stands in stark contrast to that assessed to come on stream in developed countries. North America and Europe combined, show an increase of 0.7 mb/d for the period to 2015 and this does not take into account any planned or potential capacity closures. In addition to crude distillation capacity, a relatively

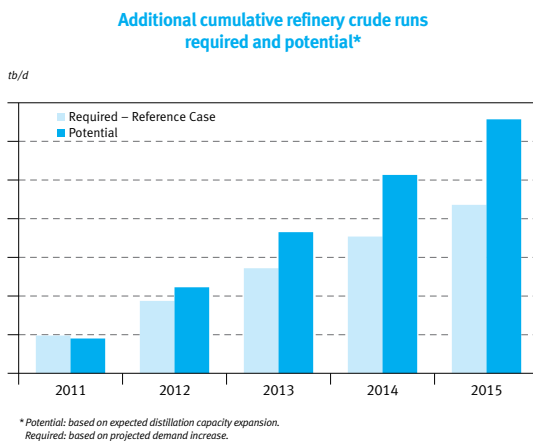
Distillation capacity additions from existing projects
2011–2015



high proportion of secondary process units will be added to the global refining system in the medium-term. Additions to conversion units are estimated at 4.4 mb/d, driven by strong demand for light products, especially middle distillates. Desulphurization capacity additions exceed those for new distillation capacity, reflecting the continued worldwide trend to low and ultra-low sulphur fuels.

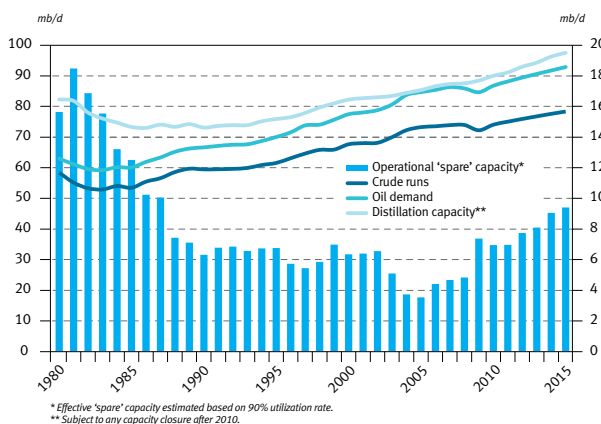
Crude distillation capacity additions are projected to exceed requirements in the medium-term

The net effect of assessed 'firm' projects is that excess refinery capacity is anticipated to grow by 2.5 mb/d by 2015 compared to current levels, assuming no refinery closures. This reinforces the expectation of a challenging period for the industry, with lower refinery utilizations and weak margins. Moreover, strong regional differences will apply, notably between the continuing growth requirements in non-OECD regions, especially Asia, and surpluses in the US, Europe and Japan.



Effective refining 'spare capacity' approaching the level of 10 mb/d by 2015

Global oil demand, refining capacity and crude runs 1980-2015



In 2009, the oil demand collapse, combined with refinery capacity additions, led to substantially lower throughputs. This shifted effective 'spare capacity' in the global refining system to a level of more than 7 mb/d. Accounting for new projects coming on stream, the overall refining surplus could approach 10 mb/d by 2015, unless some capacity is closed. Thus, today's refinery projects – and

those assessed to come on stream in the next few years – potentially represent a substantial proportion of the total additions needed over the next 10-to-15 years.

Capacity rationalization in the refining sector appears inevitable

The medium-term outlook for the downstream sector indicates sustained pressure for capacity rationalization, especially in OECD regions. The US and Europe are home to the largest capacity overhangs. In Europe, only a few facilities have been formally shut, with a total capacity of around 500,000 b/d. The prevailing trend has been to sell refineries or undertake extended maintenance and temporary shutdowns. In the US, a combination of expanding local crude production, healthy margins due to wide West Texas Intermediate differentials and rising export opportunities, could act to support capacity, leading to only minor closures in the US over the next few years. The one country where closures currently look set to occur at scale is Japan, where up to 1 mb/d of distillation capacity could eventually be closed by 2015. China is another case where legislation is likely to have an impact. However, this is related to the goal of eliminating the country's small refineries with capacities below 40,000 b/d. The elimination of very small refineries could also take place in Russia.

Declining crude share leaves little room for further refining expansion in the long-term

It is significant that, beyond the 6.8 mb/d of known projects expected to be on stream by 2015, the Reference Case outlook shows that only an additional 10.5 mb/d of cumulative additions will be needed by 2035. In the subsequent five-year periods after 2015, the required level of capacity additions averages only around 0.4–0.5 mb/d p.a. The underlying reason for this trend is that non-crude supplies increase faster than demand, and thus, as a proportion of total supply. It means that less incremental refining capacity is needed per barrel of incremental liquids demand. Indeed, by 2035, it is

Global demand growth and refinery distillation capacity additions by period mb/d

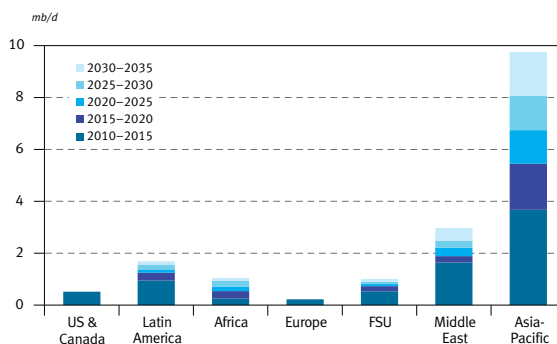
	Global demand growth	Distillation capacity additions			
		Known projects	New units	Total	Annualized
2010–2015	6.1	6.8	1.0	7.8	1.6
2015–2020	4.9	0.0	2.8	2.8	0.6
2020–2025	4.2	0.0	2.0	2.0	0.4
2025–2030	3.9	0.0	2.1	2.1	0.4
2030–2035	3.8	0.0	2.5	2.5	0.5

expected that the total supply of around 110 mb/d will be met by close to 82 mb/d of crude-based supplies and 27 mb/d of non-crudes (including processing gains).

Asia-Pacific will dominate long-term future capacity additions

The vast majority of required refining capacity expansions to 2035 are projected for the Asia-Pacific and Middle East regions, 9.8 and 3 mb/d respectively, from a global total of 17.2 mb/d. Growth in the Asia-Pacific is dominated by China and India. In Latin America, projected capacity additions of 1.7 mb/d by 2035 exceed the estimated moderate demand growth of 1.3 mb/d for the same period. Capacity requirements in Africa and the FSU region are in the range of 1 mb/d. The outlook in these regions differs markedly to that for industrialized countries, which beyond projects already under construction, see virtually no capacity expansion.

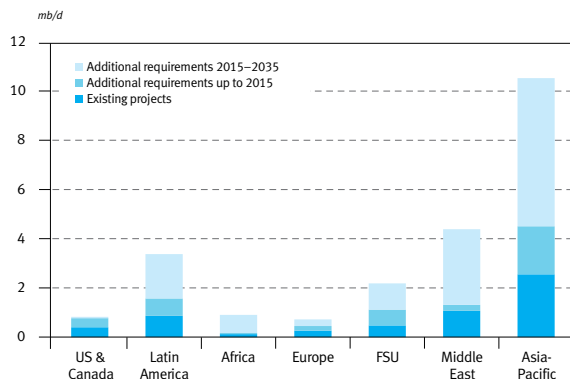
Crude distillation capacity additions in the Reference Case by period, 2010–2035



Growing importance of hydro-cracking units

Recent projections highlight a sustained need for incremental hydro-cracking, some 10 mb/d out of the 14 mb/d of global conversion capacity requirements by 2035. The need to keep investing in additional hydro-cracking capacity, with its high process energy and hydrogen costs, is expected to help support future wide distillate margins

Global capacity requirements by process type, 2010–2035



relative to crude oil and other light products. In contrast, recent substantial coking capacity additions, together with limited medium-term exports of heavy sour crudes, has led to a coking surplus, which is expected to further expand as new projects come on stream. Therefore, between 2015 and 2035, less than 1 mb/d of further coking additions are projected. The outlook for

catalytic cracking is similar. It is adversely impacted by relatively slow gasoline demand growth and rising ethanol supply in the Atlantic Basin. Moreover, total conversion additions of close to 10 mb/d, above projects currently being developed, are almost 100% of distillation capacity additions. This reflects the need to increase the production of light products for every barrel of crude processed. Substantial desulphurization capacity additions will also be necessary to meet sulphur content specifications, as non-OECD regions, in particular, move progressively towards low and ultra-low sulphur standards for domestic fuels – often following the Euro III/IV/V standards. In addition, these regions can be expected to use this new capacity for exports to countries that already have advanced ultra-low sulphur standards. Over and above existing projects of 5.8 mb/d, a further 4.2 mb/d is projected to be needed by 2015, and some 13 mb/d from 2015–2035.

Oil trade continues to expand

Oil trade between the 18 model regions of the WOO's downstream outlook is set to grow over the entire forecast period. It will increase by around 4 mb/d in the period to 2015, compared to 2010 levels. Between 2015 and 2035, total oil movements are projected to increase by more than 8 mb/d, reaching a level close to 70 mb/d by 2035. Moreover, product exports will grow faster than those for crude oil. Steady increases in global crude oil exports are a result of varying trends at the regional level. The most obvious is the expanding importance of the Middle East as the key crude exporting region in the decades ahead. The largest increase in inter-regional movements relates to crude oil exports from the Middle East to the Asia-Pacific; an increase of 7 mb/d from 2010–2035. In relative terms, however, Russia and the Caspian countries will more than triple their crude exports to the Asia-Pacific, as new pipelines to China and Russia's Far East become operational. And at the same time, exports to Europe are significantly reduced. Similarly, Africa will almost double its crude exports to the Asia-Pacific by 2035.

Uncertainties surround refining investments

Substantial capital investments are required to expand and provide maintenance to the global refining system. In the period to 2035, investments are estimated at around \$1.2 trillion in the Reference Case, of which \$210 billion is for existing projects, \$300 billion for required additions and close to \$700 billion for maintenance and replacement. This excludes related infrastructure investments beyond the refinery gate, such as port facilities, storage and pipelines. These investments are, however, subject to a number of uncertainties. A refining sector that is being squeezed by the rising supply of non-crudes, could become even more pressured by further liquids supply growth, notably from NGLs, given the emergence of shale gas. In addition, biofuels represent a further 'wildcard', especially if second and third generation biofuels evolve faster than expected. On the demand side, while non-OECD demand looks robust,

transportation efficiency measures in industrialized regions could lead to steeper declines there, and policy measures could reshape the demand slate. And, if the crude price to natural gas price ratio remains wide enough, liquefied natural gas could become an attractive option for marine fuels replacement, especially longer term, and on new build ships. Moreover, there are the uncertainties surrounding possible capacity shutdowns. This suggests a cautious approach should be adopted with respect to future refining investment decisions.

Adverse impacts of climate change mitigation response measures

No agreement has yet been reached in identifying a long-term goal for greenhouse gas (GHG) emissions reduction. Nevertheless, much work has been undertaken to explore implications of limiting the global average temperature to a rise of less than 2°C above pre-industrial levels, and corresponding atmospheric GHG concentrations. Although there is uncertainty over the fundamental relationship between GHG concentrations and temperature rises, it is clear that mitigation response measures could lead to large oil demand reductions, relative to the Reference Case. An important issue is the type of policies and measures that are undertaken to satisfy a given GHG emission limitation/reduction path. The other important question is how the loss in oil demand would be shared between OPEC and non-OPEC in terms of lower supply and the effect on the oil price. Under all circumstances, the implications for net OPEC crude oil export revenues would be substantial. Revenue per head in OPEC Member Countries would continuously fall. They would also be lower than historical levels. Other adverse impact channels include lower domestic demand and GDP, more expensive imports, increased financing costs, job losses and lower competitiveness. The importance of such adverse effects, actual and potential, on all developing countries, particularly those identified in Article 4, paragraph 8, of the Convention, suggests an urgent need to establish a permanent forum on response measures under the Conference of the Parties to the UNFCCC.

The importance of alleviating energy poverty

Figures from the United Nations show that 1.4 billion people have no access to electricity and some 2.7 billion rely on biomass for their basic needs. Moreover, according to the World Health Organization, relying on biomass means 1.45 million premature deaths per year, most of them children, a death toll greater than that caused by malaria or tuberculosis. It is essential that the world effectively tackles the issue of energy poverty, as a means of achieving the Millennium Development Goal (MDG) of halving the proportion of people in poverty by 2015. Sustainable development is a high priority agenda item for OPEC Member Countries. It is also the main objective of the assistance they provide to other developing countries, directly through their own aid institutions, as well as through the OPEC Fund for International Development. In total, they have provided close to \$350 billion (in 2007 prices) in development assistance to other developing countries in the period 1973–2010. This amounts to

nearly \$10 billion a year. A significant portion of this amount, \$69 billion, has been devoted to energy related projects, covering a diverse portfolio of energy sources that includes financial support to renewable energy sources. Rio+20 next year is a great opportunity to take stock, particularly in terms of the MDGs, and to define improved processes, structures and means for achieving sustainable development.

The crucial importance of human resources

The future availability of qualified technical talent remains a major challenge facing the oil industry. The Great Recession has had a significant impact in terms of job losses and a lack of job creation. However, the origins of this talent shortfall lie back in the 1980s and 1990s. It was then that the oil and gas industry saw a wave of cost cutting and redundancies, as a result of which many technical people who were then entering their mid-career left the industry for good. The industry will need more qualified people in the years ahead. It begs the question: how can the industry find, hire, train and keep talented people? The industry needs to be made more attractive; to make it accepted as an inclusive and forward looking workplace. A related issue is that of local content. This is of particular relevance to many oil and gas producing developing countries. Local content is crucial role as it can, and should, provide a strong platform for a country's economic and social development.

Energy and water: a much neglected issue

An oft neglected aspect of the energy industry is the impact that production activity can have upon water resources. Competition for this precious resource, not just in the energy sector, but also among other industries, such as agriculture, as well as from communities, is becoming increasingly visible. Processes can have effects upon the availability of water, as well as the potential contamination of supplies. It is important, therefore, to be aware of the crucial water-related challenges that lie ahead in the energy sector. For transportation fuels, it is worth noting that all alternatives to oil, when produced from conventional sources, use substantially more water in their production processes, with the exception of natural gas. It is also well known that production from oil sands involves substantial amounts of water, and more recently, emerging trends in the production of both shale gas and shale oil has drawn attention to their possible impact on water supplies. A major question for these industries will be to what extent, and how rapidly, the use of water, in terms of volumes consumed, and in potentially compromising water quality through pollution side-effects, will eventually have to be factored into cost estimates.

Dialogue and cooperation continue to support market stability

In a world of growing interdependence, the importance of dialogue is widely acknowledged. This is underscored in OPEC's Long-Term Strategy and the 'Riyadh Declaration', which concluded the Third OPEC Summit in November 2007. OPEC

has also been broadening and strengthening its dialogue with consuming and producing countries, as well as other international institutions. The issues at stake are complex, broad and inter-related. They require concerted efforts and, where appropriate, joint collaboration, to find adequate, cooperative and sustainable solutions. Close engagement with major stakeholders at various levels is essential to advance mutual understanding on common challenges, such as security of supply and demand, investments, cleaner fossil fuel technologies, environmental protection, the role of petroleum in promoting sustainable development and energy poverty. Expanded, in-depth dialogue, builds confidence, aids long-term market stability, and can attend to the concerns of both producers and consumers, particularly at times of high volatility in markets.