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WORLD ENERGY OUTLOOK 2008 FACT SHEET: GLOBAL ENERGY TRENDS

Where are we headed without new policies and what does it mean?

- **The impact of the credit crisis on world economic growth prospects, higher energy prices and some notable new policy initiatives have left their mark on the *World Energy Outlook 2008*.** Energy use grows more slowly to 2030 than projected last year, but the overall trends are broadly unchanged: persistent dominance of fossil fuels - oil, gas and coal - in the energy mix; a rising share of emerging economies in global energy consumption; an increase in the consuming countries' reliance on imports of oil and gas; and an inexorable rise in global CO₂ emissions.
- **In our Reference Scenario, which assumes no new government policies beyond those already adopted by mid-2008, world primary energy demand expands by 45% between 2006 and 2030 - an average rate of growth of 1.6% per year.** Fossil fuels account for 80% of the world's primary energy mix in 2030 - down only slightly on today. Oil remains the dominant fuel, though demand for coal rises more than any other fuel. The share of natural gas in total energy demand rises marginally. Modern renewable technologies grow most rapidly, overtaking gas soon after 2010 to become the second-largest source of electricity behind coal. These trends take account of current policies to reduce subsidies on energy consumption, which amounted to a staggering \$310 billion in the 20 largest non-OECD countries alone in 2007 (of which oil subsidies accounted for \$150 billion).
- **China and India account for over half of incremental energy demand to 2030.** The Middle East emerges as a major new demand centre, contributing a further 11% to incremental world demand. Collectively, non-OECD countries account for 87% of the increase, their share of world primary energy demand rising from 51% to 62%. The share of the world's energy consumed in cities grows from two-thirds to almost three-quarters in 2030.
- **As almost all of the increase in energy production to 2030 occurs in non-OECD countries,** the reliance on imported oil and gas of the main consuming regions, including the OECD and Asian economies, increases substantially. This consolidates mutual dependence but also enhances the risk of supply interruptions, as much of the additional oil imports have to transit vulnerable maritime routes.
- **Cumulative investment in energy-supply infrastructure amounts to \$26.3 trillion to 2030.** Unit capital costs, especially in the upstream oil and gas industry, have continued to surge in the last year, more than offsetting the slower projected rate of growth in supply. While the credit squeeze is not expected to affect long-term investment, it could delay spending in the medium-term, especially in the power sector, which accounts for \$13.6 trillion, or 52% of the total. Most of the rest goes to oil and gas, mainly for exploration and development and mostly in non-OECD regions.
- **These trends highlight the extent of the challenge of securing the supply of reliable and affordable energy and effecting a rapid transition to a low-carbon, efficient and environmentally benign energy system.** The Reference Scenario, characterised by rising energy prices, increased import dependence and rising greenhouse-gas emissions, is unsustainable - environmentally, economically and socially. Achieving a more secure, low-carbon energy system calls for radical action by governments at national and local levels, and through participation in co-ordinated international mechanisms.



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WORLD ENERGY OUTLOOK 2008 FACT SHEET: OIL DEMAND

What are the prospects for oil consumption to 2030?

- **World oil demand is set to continue to expand through to 2030 on current trends, albeit more slowly than over the past two decades.** In the Reference Scenario, which assumes no change in government policies, primary demand for oil (excluding biofuels) rises by 1% per year on average, from 85 million barrels per day in 2007 to 106 mb/d in 2030. This is a significant downward revision from last year's *Outlook*, reflecting mainly the impact of higher prices and slightly slower GDP growth. New policies to promote more fuel-efficient vehicles and encourage biofuels introduced in the past year - notably in the United States and Europe - also contribute to slower demand.
- **These global trends mask big differences across regions. All of the projected increase in world oil demand comes from non-OECD countries.** India sees the fastest growth, averaging 3.9% per year over the projection period (to 2030), followed by China, at 3.5%. High as they are, these growth rates are still significantly lower than in the past. Other emerging Asian economies and the Middle East also see rapid growth. In stark contrast, demand in all three OECD regions (North America, Europe and the Pacific) falls, due to declining non-transport demand. The share of OECD countries in global oil demand drops from 57% in 2007 to 43% in 2030.
- **Faster economic growth, which remains the principal driver of oil demand, explains the higher rate of oil-demand growth in non-OECD countries.** In the Reference Scenario, oil intensity (the amount of oil consumed per dollar of GDP) falls in all regions, but more quickly in non-OECD countries - especially over the next ten years - because prices to end users are assumed to rise more in percentage terms as subsidies are reduced.
- **The assumed reduction in price subsidies on oil products in many non-OECD countries contributes significantly to the projected slowdown in oil demand.** Oil consumption subsidies amounted to an estimated \$150 billion in the 20 largest energy-consuming non-OECD countries in 2007. The majority of oil consumers worldwide do not pay prices that fully reflect international market levels. By contrast, high excise-tax rates in most OECD countries mean that increases in international prices lead to much smaller proportionate increases in final prices.
- **Around three-quarters of the projected increase in oil demand worldwide comes from the transport sector - the sector least responsive, in the short term, to price changes.** Despite continuing improvements in average vehicle fuel efficiency, the sheer growth of the car fleet - from an estimated 650 million in 2005 to about 1.4 billion by 2030 - is expected to continue to push up total oil use for transport purposes. There is not expected to be any major shift away from conventionally-fuelled vehicles before 2030, though the penetration of hybrid-electric cars is projected to rise, reducing oil demand growth.
- **These oil demand projections, combined with our oil price assumptions, point to persistently high levels of spending on oil in both OECD and non-OECD countries.** As a share of world GDP at market exchange rates, oil spending soared from a little over 1% in 1999 to around 4% in 2007, contributing to the economic downturn experienced by most oil-consuming countries. That share is projected to stabilise at around 5% over much of the projection period. For non-OECD countries, the share averages 6% to 7%.



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WORLD ENERGY OUTLOOK 2008 FACT SHEET: OIL SUPPLY

Where will the oil needed to meet growing world demand come from?

- **World oil production, net of processing gains, is projected to rise from 82 mb/d in 2007 to 104 mb/d in 2030 in the Reference Scenario.** Although global oil production in total is not expected to peak before 2030, production of conventional crude oil and natural gas liquids (NGLs) is projected to level off towards the end of the projection period. Conventional crude oil production alone increases only modestly over 2007-2030 - by 5 mb/d - as almost all the additional capacity from new oilfields is offset by declines in output at existing fields. The bulk of the net increase in total oil production comes from NGLs (driven by the relatively rapid expansion in gas supply) and from non-conventional resources and technologies, notably Canadian oil sands.
- **Most of the increase in world oil output is expected to come from OPEC countries, their collective share rising from 44% in 2007 to 51% in 2030.** Saudi Arabia remains the world's largest producer throughout the projection period, its output climbing from 10.2 mb/d in 2007 to 15.6 mb/d in 2030. Non-OPEC conventional oil production is already at plateau and is projected to start to decline by around the middle of the next decade, accelerating through to the end of the projection period as new discoveries dwindle and the size of new fields falls, driving up marginal development costs.
- **The world's endowment of oil is large enough to support the projected rise in output, but rising oilfield decline rates will push up investment needs.** Proven reserves of close to 1.3 trillion barrels equal more than 40 years of output at current rates; remaining recoverable resources of conventional oil alone are almost twice as big. But there can be no guarantee that those resources will be exploited quickly enough to meet the level of demand projected in our Reference Scenario. Decline rates - the rate at which individual oilfields decline annually - are set to accelerate in the long term in each major world region. The average observed decline rate worldwide is currently 6.7% for fields that have passed their production peak. This rate rises to 8.6% in 2030.
- **Even if oil demand was to remain flat to 2030, 45 mb/d of gross capacity - roughly four times the current capacity of Saudi Arabia - would need to be built worldwide by 2030 just to offset the effect of oilfield decline.** Massive investment will be needed to achieve this. Total upstream investment (in oil and gas fields) more than tripled between 2000 and 2007 to \$390 billion. But most of this increase was to meet higher unit costs. Although the amount of investment needed annually over the projection period is lower than actual spending at present, much more capital needs to go to the resource-rich regions, notably the Middle East, where unit costs are lowest.
- **Around 7 mb/d of additional capacity, over and above the 23 mb/d that will come from the significant number of projects currently under way, needs to be brought on stream by 2015.** The current wave of upstream investment looks set to boost net oil-production capacity in the next two to three years but tail off after 2010. More capacity will need to be sanctioned within the next two years, to avoid a fall in spare capacity towards the middle of the next decade and a possible supply crunch. In view of the current financial crisis, there are growing doubts about whether all of this capacity will be forthcoming.
- **Major structural changes are underway in the oil and gas industry, with national companies playing an increasingly dominant role.** In the Reference Scenario, they account for about 80% of incremental production of both oil and gas to 2030.



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WORLD ENERGY OUTLOOK 2008 FACT SHEET: IMPLICATIONS FOR CLIMATE CHANGE

What do current trends in energy use mean for greenhouse-gas emissions and the global climate?

- **Rising global consumption of fossil fuels is still set to drive up greenhouse-gas emissions and global temperatures, resulting in potentially catastrophic and irreversible climate change.** The projected rise in emissions in the Reference Scenario, in which no change in government policies is assumed, puts us on a course of doubling the concentration of those gases in the atmosphere to around 1 000 parts per million of CO₂-equivalent by the end of this century. This would lead to an eventual global temperature increase of up to 6 °C.
- **Global energy-related CO₂ emissions are projected to rise from 28 gigatonnes (Gt) in 2006 to 41 Gt in 2030 - an increase of 45%¹.** The 2030 figure is only 1 Gt lower than that projected in last year's *Outlook*, even though we assume slower world economic growth and higher energy prices. World greenhouse-gas emissions, including non-energy CO₂ and all other gases, are projected to grow from 44 Gt CO₂-eq in 2005 to 60 Gt CO₂-eq in 2030 - an increase of 35%.
- **Three-quarters of the projected increase in energy-related CO₂ emissions arises in China, India and the Middle East, and 97% in non-OECD countries as a whole.** Emissions in the OECD reach a peak soon after 2020 and then decline. Only in Europe and Japan are emissions in 2030 lower than today. The bulk of the increase in global energy-related CO₂ emissions is expected to come from cities, their share rising from 71% in 2006 to 76% in 2030 as a result of urbanisation. City residents tend to consume more energy than rural residents, so they emit more CO₂ per capita.
- **The power generation and transport sectors contribute over 70% of the projected increase in world energy-related CO₂ emissions to 2030.** The projected increase in power sector emissions in the OECD - 0.4 Gt between 2006 and 2030 - is less than the increase in emissions from China's power plants in the past two years alone.
- **Three-quarters of the projected output of electricity worldwide in 2020 (and more than half in 2030) comes from power stations that are already operating today.** The rate of capital-stock turnover is particularly slow in the power sector, where large up-front costs and long operating lifetimes mean that plants that have already been built are effectively "locked-in". As a result, even if all power plants built from now onwards were carbon-free, CO₂ emissions from the power sector would still be only 25%, or 4 Gt, lower in 2020 relative to the Reference Scenario.
- **Strong, urgent action is needed to curb the growth in greenhouse-gas emissions projected in the Reference Scenario.** The post-2012 global climate-change policy regime that is expected to be established at the UN conference on climate change in Copenhagen in 2009 will provide the international framework for that action. With energy-related CO₂ accounting for 61% of global greenhouse-gas emissions today, the energy sector will have to be at the heart of discussions on what level of concentration to aim for and how to achieve it. The target that is set for the long-term stabilisation of greenhouse-gas concentration will determine the pace of the required transformation of the global energy system, as well as how stringent the policy responses will need to be.

1. 250 coal power plants operating at 500MW create around 1GT (1 billion tons) of CO₂ per year



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WORLD ENERGY OUTLOOK 2008 FACT SHEET: POST - 2012 CLIMATE SCENARIOS

What might a low-carbon energy future look like?

- **Without a change in policy, the world is on a path for a rise in global temperature of up to 6°C.** WEO-2008 assesses the implications for the energy sector of efforts to put the world onto a different trajectory, by means of a 550 Policy Scenario, in which greenhouse-gas concentration is stabilised at 550 ppm CO₂-equivalent and temperature rises by about 3°C, and of a 450 Policy Scenario which results in a 2°C increase. The two policy scenarios have a similar emissions trajectory until 2020, but emissions fall much more sharply after 2020 in the 450 Policy Scenario.
- **Both climate-policy scenarios assume a hybrid policy approach, comprising a plausible combination of cap-and-trade systems, sectoral agreements and national measures.** A cap-and-trade system has been modelled for the power-generation and industry sectors in the OECD+ (OECD and other EU) group of countries; this is expanded post-2020, in the 450 Policy Scenario only, to the Other Major Economies group, which includes China and India. International sectoral agreements - covering iron and steel, cement, aviation and road transport - operate across OECD+ and Other Major Economies, while national policies are assumed to be implemented for all sectors in Other Countries, and worldwide in the buildings sector.
- **Energy-related CO₂ emissions rise from 27 Gt in 2006 to 33 Gt in 2030 in the 550 Policy Scenario - 19% lower than in the Reference Scenario.** The share of low-carbon energy - hydropower, nuclear, biomass, renewables and fossil-fuel power plants with carbon capture and storage (CCS) - in the world primary energy mix increases from 19% in 2006 to 25% in 2030. Thanks to lower demand, OECD oil and gas imports are 15% lower than in the Reference Scenario; international oil prices are 18% lower.
- **The shift in the energy mix that brings about these emissions reductions requires much more investment in energy-related infrastructure and equipment.** Global energy investment in 2010-2030 is \$4.1 trillion (or 0.25% of annual world GDP) *higher* in the 550 Policy Scenario than in the Reference Scenario. Most extra spending is on the demand side, with \$17 per person per year spent worldwide on more efficient cars, appliances and buildings. Investment in power plants is \$1.2 trillion higher, three-quarters in OECD countries. On the other hand, improved energy efficiency delivers fuel cost savings of over \$7 trillion between 2010 and 2030.
- **The scale of the challenge in the 450 Policy Scenario is even greater, with world energy-related CO₂ emissions dropping sharply from 2020 onwards, reaching 25.7 Gt in 2030.** The 2030 emissions level for the world as a whole is less than the level of projected emissions for non-OECD countries alone in the Reference Scenario. In other words, the OECD countries alone cannot put the world onto the path to 450-ppm trajectory, even if they were to reduce their emissions to zero. Achieving such an outcome will require much more rapid growth in the use of hydropower, biomass, wind and other renewables - which together account for 40% of global power generation by 2030. Yet-to-be-demonstrated technologies such as carbon capture and storage (CCS) also contribute significantly to lower emissions. Relative to the Reference Scenario, global energy investment is \$9.3 trillion, or 0.55% of annual world GDP, higher. Fuel savings, at \$5.8 trillion, are lower than in the 550 Policy Scenario.



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WORLD ENERGY OUTLOOK 2008 FACT SHEET: SUB-SAHARAN AFRICA

Could revenues in oil- and gas-rich sub-Saharan African countries alleviate energy poverty?

- **Oil and gas exports in the top-ten producing sub-Saharan African countries are set to grow steadily to 2030, providing the means for alleviating poverty and expanding energy access.** In the Reference Scenario, in which no change in government policies is assumed, their oil exports rise from 5.1 mb/d in aggregate in 2007 to 6.4 mb/d in 2030. Gas exports, largely as liquefied natural gas (LNG), increase from 21.6 bcm in 2006 to 130 bcm in 2030. These projections hinge on a reduction in gas flaring, adequate investment and avoidance of disruption to supplies through civil unrest. The ten countries flared 40 bcm in 2005 – almost three times the entire region’s gas consumption. These countries could make direct use of their gas resources by using currently flared gas for power generation or distributing it in cities. The liquefied petroleum gas (LPG) extracted from natural gas or produced in refineries can provide a low-cost source of supply for distribution networks.
- **Less than a third of households in the majority of oil- and gas-rich countries have access to electricity or to clean fuels for cooking, like LPG, kerosene, biogas and ethanol gelfuel.** About 150 000 people, mainly women and children, die prematurely each year in these countries because of indoor air pollution from burning traditional fuels - essentially fuelwood and charcoal - for cooking in inefficient stoves or open fires. In the absence of new policy initiatives, the number of people living without electricity and relying on fuelwood and charcoal for cooking rises over the *Outlook* period, as the population grows.
- **Government revenues from oil and gas are set to rise strongly, giving these countries the means to speed up economic and social development and alleviate poverty.** The government take in the top ten oil- and gas-producing countries is projected to rise from some \$80 billion in 2006 to about \$250 billion in 2030. Nigeria and Angola account for 86% of the \$4.1 trillion cumulative revenues of all ten countries over 2006-2030. All these countries desperately need sustained and sustainable economic development. Modern energy services are a crucial prerequisite, bringing major benefits to public health, social welfare and economic productivity. In most of the countries, improving energy access will entail fundamental political, institutional and legislative reform, as well as efforts to strengthen the capability of regional and local authorities to implement programmes and to expand access to credit.
- **The upfront cost of expanding access to modern energy is small relative to the wealth that these countries’ hydrocarbon resources will generate.** An estimated \$18 billion is needed to achieve universal access to electricity and to LPG cooking stoves and cylinders - a mere 0.4% of the projected cumulative government revenues from oil and gas export revenues in 2007-2030. The cost relative to the government take in Equatorial Guinea, Angola and Gabon is only 0.1%.
- **Sub-Saharan Africa’s hydrocarbon-resource wealth will lead to economic development only if governments manage wisely and honestly the development of the sector and the revenues that accrue.** An improvement in the efficiency and transparency of revenue allocation and the accountability of governments in the use of public funds would improve the likelihood that oil and gas revenues are actually used to alleviate poverty generally and energy poverty specifically.