Energy - the Global Outlook

Philip Aiken's Address to the KPMG Global Energy Conference, Houston, May 2004

Good afternoon

It's a great pleasure for me to speak to you today and I thank KPMG for the invitation to do so. It's always a pleasure to visit Houston, which I do on a very regular basis. This time I am here for some of our management meetings, and today I have brought along members of our Petroleum Executive Committee who are sitting amongst you in the audience. Later they can assist me in answering questions – at least, the ones that I can't answer.

In this keynote address I want to give you some observations about the energy industry generally and the hydrocarbon sector in particular. I shall review the outlook for fossil fuels in a global context and give you some thoughts on where the main drivers and challenges lie for the industry in the future.

BHP Billiton, our company, is unique in the resources industry because it is one of only a very few companies that has interests pretty well across all primary fossil fuels. We have global oil and gas interests and produce oil, condensates, LPG, pipeline gas and liquefied natural gas. We also have extensive coal interests – we produce both energy coal for power generation and also metallurgical coal used in the steel making industry.

In March we underwent an internal organisational re-alignment of our business. We have brought our energy coal assets and our petroleum activities under one umbrella. We call this group BHP Billiton Energy. There are a number of good reasons for realigning the business in this way. Consolidation of our energy businesses will ensure we will be better placed to respond in a flexible and timely manner to changes in the energy industry, allowing us to optimise value across the spectrum of energy commodities over the long-term. It will also allow us to apply our capabilities across those areas such as coal bed methane that span more than one energy type. From a customer perspective, we also feel that there are significant benefits for many of our customers to be able to talk to a one-stop shop energy company, especially one that is well equipped to meet their total energy requirements.

I am certainly looking forward to leading this new entity. Energy is a challenging and stimulating sector to be part of – it has something for everyone, political challenges, technical challenges, commercial challenges and environmental challenges.

Slide 2: The major energy players by market capitalisation.

The energy industry is truly huge. The chart shows the market capitalisation for the top 50 energy companies as at March 2004. The industry, specifically the oil and gas industry is dominated by the three supermajors – ExxonMobil, BP and Shell. BHP Billiton ranks at no. 8 in this chart, so as you can see we are amongst the larger players, with oil, gas and coal businesses. The total market capitalisation of the sector is more than 2 trillion US$, and that is before the value of the national assets such as national oil companies are included. To put this in context, the Market Capitalisation of the top 50 listed companies globally in the Auto Car/Light truck category on 13 May was one trillion US dollars. So - Energy is a truly global and huge industry sector.

The outlook I am going to present today is primarily based on data sourced from the International Energy Agency's World Energy Outlook 2002 and the US DOE Energy Information Administration's recently published International Energy Outlook 2004.

So what does this industry do?

Slide 3: Pie chart on energy type percentage

Well the industry provides the energy that the world demands through a chain of activities that involve undertaking high-risk exploration, providing capital investment and supplying operational expertise.

As you can see from the chart the world consumes some 404 quadrillion British thermal units or 68 billion barrels of oil equivalent each year as primary energy – that's nearly 200 million barrels per day. The hydrocarbon contribution is 86%, while the non hydrocarbon sector, that is nuclear energy, renewables, and hydro forming the remaining 14%. A clear and not surprising fact, which demonstrates the importance of fossil fuels today.

Looking to the future, world energy demand will continue to grow, although growth rates may not be high, on average around 1.8% per annum – a little over half of projected global GDP growth. However, given the scale of the industry this represents a large incremental demand in absolute terms. This will have tremendous implications for investment patterns into the future – we'll take a look at that later.

The growth in energy demand will be considerably different in developing and industrialised nations. In the developing nations, energy demand will grow at a rate of 2.7% per annum, more than double that of the developing nations where the growth rate will be 1.2%. Asia, for example, is expected to double its demand for energy by 2025.

In contrast, energy markets in industrialised nations are mature, population growth is quite low, efficiency in energy use is relatively high and energy intensity (that is the consumption per unit of economic output) has fallen, as those countries move away from energy intensive manufacturing industries and towards lighter industries and services. Also there is forecast to be relatively low growth in demand in Eastern Europe and the former Soviet Union – around 1.5% per annum as a result of declining populations and major improvements in efficiency in energy use that can be expected in the future.

The bottom line is that global demand is expected to increase, especially in the developing world. All primary sources of energy will be in greater demand, and furthermore, fossil fuels will meet the major share of this incremental energy demand for at least the next two decades. It is difficult to see any real alternative unless there are some radical developments in the area of environmental legislation, particularly around greenhouse gas emissions.

So which energy type is going to be growing and at what rate?

Slide 4: Energy demand with Time by Fuel Type

This chart shows the growth rate by energy fuel type from the 1970s, projected through to 2025, based on the EIA's International Energy Outlook 2004 Reference Case, which assumes a moderate rate of economic growth, and an oil price that reaches $27 by 2025 in real 2002 dollars.

The first point is that despite a modest growth rate of say 1.9% per annum, oil will retain the largest share (39%) of primary energy consumption. This is despite the shift away from oil as a fuel for electricity generation, and despite the likely penetration of hydrogen fuelled vehicles into the transportation sector in the longer-term. The reality is that there are few economically attractive alternatives to oil products in the transportation sector.

Second, gas is the fastest growing energy source – 2-2.5% per annum – driven largely by demand for power generation. Its market share will surpass that of coal on an energy equivalent basis by 2010. The rapid growth in gas consumption creates a significant need for infrastructure development, particularly in developing countries.

Third, coal will remain a very important fuel in power generation, particularly in developing Asia. While coal demand will grow in absolute terms, its market share will decline only slightly to 23% by 2025.

Fourthly, nuclear power will grow at a slow rate, but is likely to plateau by 2020 and then slowly lose market share to 5% on a global average basis by 2025. In the developing world, however, nuclear-generated electricity could grow at far higher rates, particularly in Asia.

Finally, growth in hydro-electric generation will be from some large schemes in developing Asia, but in the developed world Canada is the only country with plans for large hydro projects. Renewables such as wind, solar, geothermal and biomass will undergo growth in Western Europe and the USA where subsidised by Government, but from such an extremely low base that it will have little impact on fossil fuels.

With this growth in energy consumption, it will come as no surprise that world carbon dioxide emissions will also increase significantly. In the IEO2004 Reference case, CO2 emissions increase by 72% in 2025 over 1990 levels, or at an annual rate of 1.9% pa, despite ongoing improvements in the intensity of emissions per dollar of GDP.

By 2020, CO2 emissions in the developing world will probably surpass those in industrialised countries, accounting for about 60% of the projected increase over today's levels.

This scale of growth in energy demand that I have outlined above is basically inevitable because it is underpinned by forces that are pre-determined or already in place.

Slide 5: Energy demand growth is inevitable

Economic growth is the single most important driver of energy demand. Over the past 30 years, each 1% per annum growth in GDP has driven a 0.64% per annum growth in primary energy consumption. But it is also interesting to examine a number of specific factors.

- Firstly, population growth. According to the United Nations, population is expected to actually decline in Western and Eastern Europe and the FSU, but the world population will increase by one and a half billion people to 8.3 billion between 2000 and 2025, with Africa up 62% and Asia up 29% making up the biggest components over that period. The Middle East will increase by 64% and Latin America will also experience large percentage increase, up 32%. Interestingly, many of the OPEC oil producer nations will experience strong population growth; the ability of these nations to meet the associated social costs of a rising population will depend upon their ability to match national budget expenditures with increasing oil revenues.

In the developed world, the driver of population growth will be migration rather than the birth rate. In North America, the continued inward migration of cheap, low-skilled labour will continue to support economic growth. And migration – unlike births – has an immediate impact on energy demand.

- Secondly, the industrialisation of the developing world is another driver of continued energy demand, since these industries tend to be heavy consumers of energy. Consumption of energy per unit of economic output – energy intensity – tends to be very high in the initial stages as developing nations begin to industrialise, but diminishes with economic maturity.
- Urbanisation will also drive increased energy consumption – 80% of the world's population is likely to be urban by 2050. Major shifts in population distribution are taking place in China and India. Urban populations generally enjoy much higher incomes that rural ones – growth in per capita income is a major driver of energy demand.

Slide 6: World Primary Energy Consumption 2001-2025

This illustrates some of the points I made earlier on the overall absolute growth in energy demand, growing by over 50% by 2025 and the importance of the developing world in that demand picture.

Let me say something specifically about Asia. Asia is likely to increasingly dominate the world economy and world energy demand – as a result of three economies in particular. These are:

- **China**, which is likely to experience sustained GDP growth of 6-7% per annum and overtake Japan as Asia's largest economy. Currently it is growing at an even higher rate. Heavy industry and capital goods manufacturing are creating a huge demand for energy – in 2003, primary energy consumption was up 11%, and electrical power was up by 15%. Shortages are being experienced across all energy fuels. China is now the world's second largest oil market, behind the United States. Coal production is being switched toward the domestic market, significant new power generation capacity is being built, and LNG import terminal proposals are proliferating. Industrialisation, urbanisation, and growth in personal income will drive continued long-term growth in energy demand.

- **India**, where economic reform and strong foreign direct investment is boosting the economy. With GDP growth rates of 5-6% per annum, it is likely to overtake South Korea as the region's third largest economy. Energy demand is likely to grow strongly, driven by population growth and expansion in personal wealth - India has a huge emerging middle class. Coal-fired power generation is still dominant in India, but issues around poor domestic coal quality and transportation infrastructure may constrain further growth in consumption. Gas is likely to be the fastest growing energy fuel in India.
- And then there is **Japan**. The Japanese recovery could be short-lived with its poor demographic outlook and increasing de-industrialisation, but nevertheless it is a large and very important economy.

Now let's take a look at a number of dynamic shifts around security of supply, market reform and the environment that are taking place in global energy markets.

The depletion of indigenous resources means that many OECD countries are increasingly dependent on energy supplies from remote, non-OECD countries. For oil, this has been the case for quite some time. However, it is now happening with gas. An example of this can be seen in Europe's increasing dependence on Russian and Algerian gas. North America's future dependence on imported LNG and remote gas is another example. For coal, OECD Europe, Japan, South Korea and Taiwan are dependent on imports, while the US, China, India and Australia are not.

The major increase in international trade has significant implications for infrastructure development, but it is also pushing security of supply up the government policy agenda. This is now emerging as a major policy issue in countries and regions that were more or less self-sufficient in energy, including the UK, Europe, and the USA. Countries that have a long-term reliance on imported energy such as Japan have always been acutely sensitive to the issue of security of supply, and continue to be so, and it is notable that Asian countries are currently building their strategic oil stocks.

Countries, particularly those with limited indigenous resources, are becoming progressively more determined to ensure that they have a number of different energy supply sources. This has been the strategy employed by Japan, with its LNG supplied from a number of countries, Australia, the Middle East and Indonesia – and its energy mix being made up of a strong component of nuclear. I suspect that China will also follow a diversification of supply sources as its energy demand grows.

Market liberalisation to introduce competition, lower energy prices and promote national economic competitiveness was a dominant energy policy theme of the 1990s. Experience shows that competitive energy markets do promote lower prices overall. However, they do not necessarily provide the environment needed for investment in new infrastructure required to meet long-term energy needs.

This was joined by concerns about the impact of energy production and consumption on the environment, at both the global and local level, including concerns on climate change that led to the development of the Kyoto protocol on greenhouse gas emissions in 1997. The concerns still remain, and at this stage it is unclear how the international community will pursue the greenhouse debate. There is a difference of opinion on the nature of the steps that will be necessary to address carbon dioxide emission levels.

There is now a strong push by some countries, particularly the US, to advocate that technology can provide a permanent solution to greenhouse. That technology, which relies on the capture and sequestration of carbon dioxide, is largely unproven in any large-scale applications and the economic costs are currently only speculative. However, research and evaluation of these possibilities is underway and this will provide an important input into the overall debate which until recently has focused on limiting emissions through international agreement. Technology based solutions, including geo-sequestration have the potential to offer a realistic solution to containing greenhouse emissions whilst allowing global economic growth.

The policy themes of greenhouse, market reform and security of supply, together with ongoing growth in energy demand, are necessitating a new cycle of major infrastructure investment, estimated by the IEA to amount to $16 Trillion. Much of this is required to simply maintain current supply capacity, and about half of it in the developing world, particularly in China and other developing Asian countries. More about this later.

Slide 7: Consider each fuel

Let us consider some aspects of each fossil fuel in turn, oil, gas and coal, starting with oil.

Oil demand is expected to increase by around 40% to over 110 million barrels per day by 2025 – that's a lot of oil. For comparison, OPEC is currently producing about 27 million barrels per day – the call on OPEC crude will need to increase to over 45 million barrels per day by 2025 to meet this demand. This growth is driven by demand for oil as a transport fuel and as a feedstock for the petrochemical industry.

Demand growth will be highest in Asia, particularly China and India, and lowest in Western Europe. Demand will be driven by growth in the passenger car fleet, where increasing vehicle fuel efficiency will be more than offset by increased miles driven. Hybrid vehicles are likely to gain a foothold in the market, but fuel cells are more likely to make an impact in stationary power generation applications. The commercial road fleet is likely to remain dominated by diesel, and jet fuel demand will also grow with increasing passenger air travel and commercial air haulage. However, the use of fuel oil for power generation and heating is likely to decline, though kerosene will still be widely used as a heating fuel in Asia.

The overall trend is a shift in demand toward the light end of the barrel – gasoline, jet fuel, and the middle distillates - at the expense of residual fuel oil. This shift has some important implications for refinery investment; costs to supplier in supplying the lighter product mix will increase, and we are likely to see increased international trade in refined products in order to manage local imbalances in supply and demand.

These trends in oil demand also have another consequence – demand appears to be becoming less "elastic" to price. Recent experience indicates that oil demand can grow alongside high oil prices, and, logically, this may prove to be a long-term feature of the oil market.

The fact that recent high prices have not produced an inflationary effect on the world economy is perhaps explained by the weakness of the US dollar – the trade weighted dollar index for oil has actually fallen about 30% since 2002.

Oil prices recovered strongly from the crash of 1998 and early 1999. Initially, in 2001 to 2002, demand was impacted by the effects of 9/11 and the general global economic downturn rather than by high prices. In 2003 to 2004, oil demand has rebounded very strongly in an environment of very high prices, driven by demand in China, India, and Latin America.

I am often asked for my forecast for oil prices, and I always decline to answer or fudge it. I don't know the answers, but I would point to Alan Greenspan's recent remarks where he commented on the dramatic rise in the six-year forward futures prices for crude oil. He said that it had received little attention given the effect that this could have on the US economy, but he also said that six years is long enough to discover, drill and lift oil and hence future prices at that horizon can be viewed as effective long-term supply prices.

The impact of high crude prices on consumers is muted in situations where government duty swamps the underlying fuel price, for example in Europe. Elasticity to price may also be shrinking on the supply side as well. Through the 1990s non-OPEC industry has added new reserves at an average rate of 14 to 18 billion barrels per year, and there has been a strong correlation between oil price and gross additions to non-OPEC reserves, lagged by two years. But since 2000, despite extraordinary levels of industry investment, reserves additions have stubbornly refused to move outside of their historic range. This suggests that non-OPEC industry may now be experiencing a constraint in growing its reserves base. Indeed, despite the phenomenal success of the industry in deepwater, and the likely growth in production in the FSU and in oil sands, some analysts are confident that non-OPEC production will peak next decade.

And now Gas.
As I mentioned before, gas has been the fastest growing energy fuel since the mid 90's and this will continue to 2025.
Volumetrically, gas demand growth will be greatest in the very large markets of North America and Europe, although the highest percentage growth rates will be in the emerging economies of Asia. In Western Europe, rising electricity demand will require new gas-fired combined cycle gas turbines to replace ageing coal-fired plant and nuclear plant that is retired for technical or environmental reasons.

In North America, there has been an enormous construction program of new gas-fired generation capacity that will underpin gas demand into the next decade. The requirement for gas imports into the US has attracted a great deal of attention recently, with the realisation that indigenous US supplies are in steep decline, and gas prices have risen significantly. LNG imports in the US have to date been less than 2% of total consumption but recent studies suggest that the US could be importing 80 million tonnes per annum by 2010. Access to world gas will require a major expansion in LNG import facilities and a number of operators, including BHP Billiton, are pursuing applications to construct these facilities.

As the Chinese economy continues to boom, electricity demand is growing strongly and there is a comparable surge in construction of new generation capacity. This is driving gas demand growth rates of over 5% per annum in Asia.

Russia accounts for 10% of global gas demand but is also Europe's main supplier. With European export prices many times those of domestic gas, Russia has a clear intent to dedicate gas to export markets, while maintaining coal and nuclear to restrain domestic gas use. Russia will continue to supply export volumes to Europe, but pipeline exports to Asia will also become a major new focus.

The growth in gas means that massive investment in infrastructure will be required across the gas supply chain. LNG will be one of the biggest areas of growth, with a possible six-fold increase in LNG trade by 2030. The cost of liquefaction technology and transportation is reducing, significant global trade is developing, and directionally LNG will move towards 'commodity' status from a resource that is underpinned by long term take or pay contracts. Global trade in LNG is around 23% of total gas consumption compared with 57% for oil. Hence the bullish predictions.

Turning now to coal.
Demand for coal will grow in absolute terms; its market share will drop slightly but still remain close to 25%.

There are strong regional variations in coal demand - it will continue to play a very important role in power generation in those regions where alternative fuels are not readily available.

In China, three quarters of electricity generated is from coal. This level of penetration, coupled with dated plant and low deployment of clean coal technology, has given rise to major problems of air pollution in many Chinese cities. Government is on the one hand now diversifying its energy mix, but also desperately trying to boost coal production for the domestic market. Despite the diversification strategy, half of the new generation capacity to come on stream in 2004 will be coal-fired. This capacity is likely to have Sox, Nox and particulate clean-up equipment installed, and they will be considerably cleaner than existing plant.

In Western Europe, coal's share of energy use will drop from 14% in 2003 to just 6% in 2025, as coal-fired power units are backed out of the market as they age, impacting uncompetitive, subsidised domestic coal operations.

In North America, growth in coal consumption will be largely through higher utilisation of existing plant. Most new plant will be gas fired, although there are several proposed coal fired projects under review.

Of course, coal is particularly exposed to changes in government environmental regulation regarding CO2 and other emissions (Sox, Nox, particulates and mercury), either through a mandated reduction in coal burn, or in the imposition of CO2 emissions trading system that adds significantly to coal costs.

Whatever the outcome in specific markets, the issue of CO2 is unlikely to go away.

Technology exists for the efficient removal of Nox, Sox and most forms of mercury – this technology can be retro-fitted to existing plant at a relatively minor cost. The issue of mercury is its very low levels of concentration, measured in parts per billion, and its three different chemical forms. If emission limits are set low enough, they would effectively cause the mandated closure of coal-fired plant.

The popularity of gas as a power generation fuel compared to coal has been due to its lower capital cost, its lower exposure to future government environmental mandates and taxes, and to its higher thermal efficiency in converting fuel into electricity. Offsetting these factors has been the significantly lower cost of coal fuel.

Clean coal technology such as IGCC (Integrated Gasification Combined Cycle) represents a very high level of pollutant removal, but also promises a level of net thermal efficiency approaching that of existing gas-fired CCGT (Combined Cycle Gas Turbine) plant. Further efficiency gains in conventional gas turbines are likely to be relatively small, but the inclusion of the gasification system in IGCC technology will mean it will not reach the efficiency level of CCGT. Further improvements in IGCC technology after 2010 will lead to lower installed costs, and thereby improve the attractiveness of coal, and could result in new coal-fired generation capacity being built again in developed countries.

But the big issue remains the safe and cost-effective disposal of CO2. Commercial large-scale carbon sequestration technology is still some way off but it does offer significant potential, and is an important aspect of future coal applications. If a breakthrough were to be made, it would clearly have major ramifications for the future of all fossil fuels, but in particular coal.

It is clear that the industry faces major challenges in meeting the future energy requirements of consumers.

Slide 8: World Energy Investment 2001-2030

A new cycle of investment – estimated at $16 trillion by the International Energy Agency – will be required to replace ageing infrastructure and build new facilities in upstream production, transmission, processing and refining, shipping, and power generation.

I would commend those of you from the finance world to read the IEA report. I do not have time to discuss it in detail today but let me mention some of the main conclusions.

- The power sector will dominate energy investment. Almost ten trillion of the 16 trillion capital is needed for this sector. This is because of the rapid growth in demand, and the much higher capital cost of electricity per unit of energy than compared to direct combustion of fossil fuels. In Europe, half the current power generation capacity could be retired by 2030, including most of the existing coal-fired and nuclear capacity.
- Oil investment will shift away from the OECD countries. Of that investment outside the OECD, 45% will be in projects to supply oil to OECD countries. A quarter of the upstream investment will be needed to meet rising demand,. The rest will be needed to counter decline in production from existing facilities.
- Gas investment will grow, to compensate for the decline in production facilities and to meet the near doubling of gas demand over the projection period.
- Coal investment will depend on relative prices and environmental policies.
- The financing of energy investment cannot be taken for granted. Although global financial resources are sufficient to finance this projected energy investment, in many countries, particularly in Africa, limited domestic savings compete with other sectors and the risk /reward balance has to be right. Few governments could afford to finance these projects even if they wanted to and more capital will have to come from private and foreign sources than in the past. Financing the required investments in the developing world is the greatest challenge identified in this report.

Slide 9: Significant challenges ahead

I have painted a reasonably upbeat picture on the potential growth for energy growth. I hope I have demonstrated that there is limited option for alternative fuels to play a major role in the medium term given the projections for demand growth, and that fossil fuels will constitute the majority primary energy source. However, I have discussed some of the challenges faced by the industry. These are the ones we can identify. There are what the planners call ‘the wild cards’, that is the things we can’t identify. Energy is governed by politics – just look at history, and I am sure that there will be some ‘known unknowns’, some things we have not thought about out there in the future.

There is one statistic that always amazes me and it's quoted by the World Energy Council that on this planet there are 1.6 billion people who do not have access to affordable energy. This is both a threat and an opportunity.

So let me leave you with those challenges ahead as the energy industry inevitably grows.

- The financing of energy projects - much of it will need to be invested in very large scale projects in developing countries and across borders.
- The need to facilitate further market reform, in gas and power, without creating a climate that inhibits investment.
- The need for the industry to address environmentally-driven regulation as the principles of sustainable development are increasingly built in energy policy agendas. This is something I have not had the opportunity to discuss today. It is worthy of its own keynote address, but it is something that energy companies are embracing, and certainly it is a high priority within my own company.

And finally, perhaps one of the biggest challenges of all in developed countries, the need to build large-scale infrastructure projects while meeting community desires for small, less intrusive facilities. Obtaining the necessary "license to build" cannot be taken for granted, whether we are talking about LNG import facilities in the USA, pipelines in Latin America, or wind farms in Europe.

Slide 10: World Energy Congress Sydney

Following that summary, I can't miss the opportunity with an audience such as this to give a plug for a very important energy event that is happening later this year. It is the 19thWorld Energy Congress being held in my hometown, Sydney, Australia, in September.

It is probably the most important gathering in the energy calendar and it is a forum that will be used to discuss many of the issues we have talked about today. I indicated earlier that BHP Billiton is an energy company and has brought its petroleum and energy coal interests together. We think it makes sense – our customers who buy coal are also potential purchasers of LNG and vice versa. We sell gas oil, condensates, LPGs and LNG and coal to markets across the world.

Because of our broad profile across energy I'm pleased to say that BHP Billiton has chosen to be a major sponsor of the congress and in fact we are taking a lead role in the organisation of the Congress. I am also pleased to say that KPMG are also co-sponsors with us along with some 15 other companies with interests in the energy sector. The event is held once every three years and is the World Energy Council's flagship event where all their research studies and policy work come together for presentation. We have a substantial technical program around our theme of 'delivering sustainability in energy' and there will be distinguished speakers from the corporate sector, from governments and from regulators both from the developed and the developing world. We have some significant energy personalities giving keynote addresses and there will be a host of other associated meetings, for example, we have a ministerial forum where a number of energy ministers from around the world will give presentations and undertake debate and discussion under the chairmanship by the Australian Energy Minister.

We are expecting a large attendance from all energy sectors from a large number of countries across the world and from all areas of our business whether it be financiers or technical people or government. I would urge you that if you are interested in the energy scene this event is not to be missed, and we'd like to welcome you down to Sydney in September 2004.

Thank you for your attention today and if I can answer any questions, please feel free. Thank you.