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Challenges in Meeting Future Global Energy Demand

Thank you, Lucille for that kind introduction.

It is always a pleasure to visit this great city, and it is a special pleasure to have been invited to address this most distinguished and influential group.

As most of you may know, my company has had a long-standing and enduring business relationship with both China and Hong Kong. In fact, the reason I have had the opportunity to travel here is to celebrate the 40th anniversary of our partnership with China Light and Power in Hong Kong electricity generation.

But our history in Hong Kong and China goes back even further. In the 1890s, for example, the young petroleum industry began to serve China's markets, and we were among the earliest participants to help provide for China's energy needs. At that time, the chief product sold was kerosene, transported by sailing vessels called clipper ships. In rural China, kerosene found a ready market in replacing vegetable oils for home illumination. We advertised a small tin kerosene lamp known as *Mei Foo*, or beautiful companion, that burned brightly and cost but a few cents. And even today, the company publication we send to our shareholders is called *The Lamp*, symbolizing our desire to light the way to understanding and to chase away the shadows of misconception.

I'd like to also try to do something similar today in talking about the challenges and hurdles that stand before all of us as we work to support economic development and a more prosperous life for people around the world.

This city is a highly appropriate place to have this discussion. Hong Kong has long stood as a beacon for attracting business. It is a model for the rule of law, and has had a particularly enlightened approach to encouraging private business and the entrepreneurial spirit of individuals. No better evidence of this is needed than the preeminent place Hong Kong enjoys when it is ranked in the annual Index of Economic Freedom.

Certainly, our experience bears out Hong Kong's stellar international reputation. We are the largest U.S. investor in Hong Kong, and we have enjoyed a longstanding relationship with the Government of Hong Kong. ExxonMobil's presence and continuing interest in investing here is reflective of our confidence in the sound approach to business

development this city has taken, as well as our view that continuing new investment will be needed to meet Hong Kong's future energy needs.

One of course cannot address Hong Kong's energy needs without also considering China. In fact, China, including Hong Kong, is an extremely important and growing market for energy.

Today, I'd like to talk about the future world of energy, and how that world will affect Hong Kong and China. As the world continues to develop, there are increasing demands for energy and, with that, we are now seeing some new issues and tensions arise. Nowhere are these more salient than in this region which has enjoyed unprecedented growth in recent decades. No region has prospered as rapidly as emerging Asia during this period, and because of that energy demand growth has also been very strong.

The world outlook for energy

In addressing global energy trends, the place to start is with economic growth, because economic growth depends on having adequate and reliable amounts of affordable energy, and at the same time economic growth tends to lead to increases in energy demand.

Each year, my company's economists and planners take a long-term look at world economic trends and energy growth. Overall, we project just under 3% annual economic growth through 2030. Now of course this will fluctuate as business cycles come and go, but we think this is a reasonable long-term forecast for growth.

Energy use will also rise, but by less, because we expect that continued progress will be made in improving the efficiency of energy use. We place energy growth at a bit less than 2% annually, reflecting this improvement in energy efficiency.

This efficiency gain is actually an ambitious estimate, in that we expect the pace of improvement to accelerate and exceed that of recent decades. But even with this efficiency gain, the world will see total growth in energy demand of about 50% by 2030.

This will be a huge amount of energy. The increase in demand alone will be equivalent to more than 100 million barrels of oil per day, or about ten times Saudi Arabia's current oil production.

Now, not all of the increase in energy demand will be oil and gas. In fact, we expect the combined oil and gas share of total energy to remain relatively stable at about 60 percent through 2030. However, when you also factor in that production from existing fields declines over time, oil and gas supplies from new developments will need to be about 170 million barrels per day oil-equivalent, one-third higher than today's total oil and gas production.

Therefore, when considering the enormous energy challenges ahead of us, all of us ought to have in the forefront of our understanding the significant magnitude of the supply task.

And all of us should be asking some important questions. Asia, in particular, has some key issues to address.

For example, what type of energy will be demanded in the future? What types of energy will Asia need? What are the implications for Asia of decades of ongoing and large energy growth? What will it take for Asian countries to ensure that adequate energy is available? And, what steps will be needed worldwide to ensure we can meet our longer-term energy needs?

What type of energy will be demanded in the future?

Let me start by talking about what types of energy will be demanded by consumers.

Without a doubt, for many decades most growth in energy will be for oil, natural gas and coal. Put simply, these are abundant and affordable and we have established technologies for finding and using them.

We project that oil and gas demand will each grow by close to 40 million barrels a day oil equivalent by 2030 and coal by almost 30 million oil equivalent barrels per day. The remainder will come from other sources.

These increases will come despite an improvement in global energy intensity, which is the amount of energy used per unit of economic output. That improvement we forecast to average about 1.1% per year, or about one-third faster than the pace since 1970.

And, the increase in petroleum and coal energy demanded will come about even as alternative energy sources grow even more rapidly. For example, we believe wind and solar energy may grow at about 10% per year, but because they are such small contributors today, they will remain less than 1% of total energy in 2030.

These alternative energy sources are much discussed in the press, and they will become more important, but we cannot ignore the limitations that each have.

For example, solar energy has very high costs, wind and hydroelectric power have siting limitations, and there are constraints to significantly increasing biomass fuels due to economics and competition with alternative needs for food crops and forests.

Nuclear energy remains an important option, with rapid growth projected in China. However, nuclear power has generated considerable public opposition elsewhere, both to new plants and to waste disposal options. While we think nuclear will grow, with perhaps more upside in the longer term if its costs become more competitive, the factors I just mentioned will certainly constrain growth in many countries in the medium term.

Another energy type -- hydrogen -- has been increasingly mentioned as a possible long-term option. However, it is important to remember that hydrogen is more a battery than a primary source of energy. Hydrogen has to be produced from other materials, either hydrocarbons or water, and this process uses lots of energy and is very expensive.

In addition, broad consumer use of hydrogen poses important safety and infrastructure issues that will take decades to manage or resolve in the best of circumstances.

The limitations and dilemmas presented by these alternative energy sources are serious, and can be overcome only with research, significant investments and time.

Therefore, we are left with the reality that for many decades the vast majority of energy that we will use will be hydrocarbon energy. That is why we must face seriously the issues that arise when obtaining energy from hydrocarbons.

How much and what types of energy will Asia need?

Turning more specifically to Asia, we need to ask how much energy will this region need, and what type of energy will it be?

The short answers are much more, and of all types. Let me explain.

Because most Asian economies are growing more rapidly than countries in other regions of the world, their energy requirements will grow faster.

Specifically, we foresee average annual economic growth of 5% on average through 2030, with China a bit higher at about 6% per year.

With significant improvements in the efficiency of energy use, it may be possible to limit energy growth to slightly under 3% per year, but as my earlier comments should have made clear, this growth will still add up rapidly.

For example, for Asia's most rapidly growing countries -- which I call emerging Asia -- oil needs will likely more than double by 2030, largely due to increases in the numbers of cars and trucks. Electricity demand will likely triple, and in turn drive a tripling in natural gas demand. Coal, which today represents 35-40% of emerging Asia's energy, and about 55% in China, will continue to grow and likely double by 2030.

These trends are very different from what we expect to see in the United States and Europe. In these areas, energy use will grow much less rapidly, and will be only 20% to 30% higher in 2030 than today. That is due mainly to efficiency gains, more moderate economic growth and a much lower increase in population.

What are the implications of this energy growth for Asia?

If we are close to the mark on energy developments and energy growth, what will the implications be for countries in emerging Asia, including particularly China? Let me offer some thoughts.

First, we expect there will be many more cars. By 2030, Asia's car population could rise from about 60 million to over 400 million, which is an enormous increase and in fact

would surpass the car fleet of North America by nearly 100 million vehicles. Regardless of the precise level, there will be much more need for automotive fuel.

Second, electricity use will also increase rapidly, and about two-thirds will be supplied from coal power plants. Coal will be gradually relinquishing share to natural gas, which by 2030 will fuel nearly one-fifth of power generation needs. Hong Kong, for example, will be a growth market for natural gas in power generation. Almost all natural gas requirements will need to be imported, much of that in the form of LNG. The development of a LNG terminal in Hong Kong will be critical to maintaining reliable electricity supply in the future. Regionally, nuclear and hydropower growth is also expected, though their combined shares of power generation will likely remain well under 10%.

Third, the increase in the number of trucks and automobiles will generate a very large demand for investment in constructing the roads to accommodate them, while the much-increased electricity demand will impose very significant power sector investment burdens. To give you an example, the International Energy Agency estimates that 60% of the world's energy investment needs through 2030 will be in the power sector.

Fourth, with so many more cars and trucks, with rapid industrial growth, and with much greater electricity generation from coal, air quality and pollution concerns will become ever-greater public issues. This is already a major issue for Hong Kong as a result of rapid growth in the surrounding Pearl River Delta; so clearly, balancing between cost and cleaner fuels will be a factor for consideration for this region.

There will also be an important international dimension to this, since emissions growth in both the United States and Europe are likely to moderate over time, while Asia and China will likely see continuing significant increases.

Fifth, the dual pressures from increasing energy needs and greater environmental emissions will give an ever-stronger impetus for China to focus greater attention to the efficiency with which energy is used. China will have the benefit of being able to adopt technologies that have earlier been developed overseas, but clearly the importance of economic investments to enable efficient and wise use of energy cannot be overestimated.

Finally, the large increase in oil and gas that will be needed even with conservation and efficiency gains will mean that this region will require a very large increase in imports.

For example, a recent estimate by the International Energy Agency placed Chinese import dependence in 2030 at more than 80 percent for oil and about 30 percent of natural gas. Statistics like this have evidently attracted notice in Beijing, leading to discussion of plans to address import dependence.

If this demand and import growth materializes, the bulk of the imports will need to be supplied from Africa and the Middle East.

As a result, political stability and political developments in the Middle East and Africa will be as important to China and other countries in Asia as to anyone in the world. Asian countries, including China, will have an ever-greater stake in the resolution of problems that have arisen in the Middle East and Africa

Overall, meeting Asia's energy needs will be quite challenging in the next several decades. It will be necessary for Asian countries to adopt a full array of energy options, including more hydropower, more nuclear, more coal -- as well as importing more LNG and facilitating oil and gas production in the region.

What will it take for Asia to obtain the energy it needs?

If more energy of all kinds will be needed, what it will take for Asian countries to obtain the energy their economies will need?

Asian countries have substantial access to oil and gas resources in the region, in Russia, Southeast Asia, and Australia. Moreover, countries in this region have a strong self-interest in seeing these resources developed.

For example, the Sakhalin area offshore Far Eastern Russia has proven itself to have important resources, and ExxonMobil has major interests in major oil and gas projects there. These projects are nearing production, and they will contribute an important share of energy once they come on-stream.

Similarly, Indonesia and Malaysia both have very substantial energy resources, though these are both mature oil provinces and are unlikely to provide significant increased supplies.

On the other hand, some recent discoveries north and west of Australia will add large new supplies and will likely come into play beginning later in this decade.

Nevertheless, even in total these new sources of supply will be insufficient to meet the growth in Asian demand. There will be no way around a greater reliance on the Middle East and Africa.

Moreover, Asian countries will have to compete for these supplies with both North America and Europe. As I am sure everyone here understands, no country has a preferential right to specific energy supplies. Every country or company must compete for those supplies in the global marketplace.

Even so, the investment climate that is adopted by countries in Asia will be a critical factor in determining whether Asian countries are able to develop and attract the energy they need.

In order to ensure that regional supplies are developed, Asian countries will need to be attentive to the investment frameworks that they establish. In particular, regional governments can enhance their access to supplies by taking several steps.

One is to work cooperatively and in partnership with private companies to help ensure that new and adequate energy infrastructure can be put in place. This will include attention to timely permitting for new facility construction where this is needed.

But in addition, private investors will be interested in assurances on contract stability, with dispute settlement procedures that meet international norms, with stable legal, fiscal and regulatory regimes, and with defined and reliable contract and property rights.

The importance of these types of investment protections are understood well by those in this audience, of course, and Hong Kong continues to stand as an exemplar of how to attract investment and ensure legal protection for investors.

The current electricity regulatory framework in Hong Kong, the Scheme of Control, with its strong contractual footing, has served this purpose admirably. It has facilitated investment in CAPCO's power plants and CLP Power's transmission and distribution system to provide Hong Kong with one of the world's most reliable power systems.

These successes further highlight the importance of the proper investment climate if this region is to attract overseas investment, meet its energy needs, maintain the pace of its economic development and continue to improve the standard of living of its people.

Steps needed to meet longer-term energy needs and improve environmental quality

But there are other important considerations that are more general and relate to the more distant energy future.

First among these is the development of sufficient energy resources to meet future energy needs and support economic progress.

As time goes on, energy needs will grow. Eventually, the resources we use now will prove insufficient, or will entail costs that we would wish to mitigate.

A second and related matter is the environmental impact of energy use, and our common desire to find ways to use energy with a diminishing impact on the environment. In North America and Europe, as well as Japan, the environmental impact of energy use has been declining, with the arguable exception of carbon dioxide. The same would probably be true of Hong Kong on its own, but Hong Kong is strongly affected by the surrounding Pearl River Delta region.

This region is beginning to experience the same growing public interest and governmental involvement in moderating the environmental effects of energy use. For most of these effects automobile and energy companies have found technological answers that are economic, and these technologies are being commercialized. However, for carbon dioxide there is still no clear path forward that does not pose economic risks.

Nevertheless, many people are now studying the effects of carbon emissions on climate and the alternatives to current energy use patterns. We as a company have entered into a

collaboration with other world class companies and with Stanford University in what we call the Global Climate and Energy Project, or GCEP. The goal of this research and technology effort is several-fold.

We hope to identify the most promising technologies for low-emissions, high-efficiency energy supplies. We wish to identify the barriers to the application of these technologies on a worldwide basis. We plan on conducting research into technologies that will overcome the barriers and that can accelerate the global application of the technologies. And we plan on making our research results widely available to the scientific and engineering communities.

We are of course not alone in pursuing new technologies that will point the way toward a future with plentiful and affordable energy. Many governments and other companies are also in this hunt.

At the same time, we should not delude ourselves into thinking that this pursuit of next-generation energy will be an easy endeavor. The issues that present themselves are very hard problems to solve, there are no clear near-term answers, and no one has yet found a way to resolve the problems without risking serious economic consequences.

Yet because so many people and organizations are working very hard on this long-term issue, and because we continue to see amazing advances in technology related to energy, we should remain optimistic that our dilemmas and uncertainties will one-day yield to acceptable solutions, for people in every country. After all, human ingenuity is the most important resource that mankind possesses, and the human mind is a resource that has served us well throughout our common history.

I have appreciated this opportunity to be able to speak to you today on the energy issues faced by Asia and the world. Successfully overcoming future energy challenges will require strong cooperation between companies and government to establish the necessary investment climate and to help balance the economic and environmental concerns of the public. I believe that my company's own partnership in Hong Kong -- with CLP and with the government -- may serve as an example of what can be achieved through the necessary cooperation that will help secure our mutual energy future.

Thank you.