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## Energy Outlook and Consumption

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# Energy Outlook and Consumption

Arthur Andersen

## **Abstract**

Speech given at Session 3: Challenge Facing Resource Development. Mr. Andersen presented is a set of projections rooted in what we understand to be the current regimes of policy in the United States and elsewhere. Three key propositions inform considerations regarding long-term energy market developments: the prospect for energy demand growth is substantial and will be based on fossil fuels; growth will be centered in developing countries, particularly Asia, where living standards are rising; thanks to technological know-how, resource availability will not constrain energy supply development.

# ENERGY OUTLOOK AND CONSUMPTION

*Arthur Andersen\**

Before I start the discussion of the energy outlook, I would like to make a couple of comments about where I am in the Department of Energy. I am part of the Energy Information Administration and I know that for non-U.S. participants in this meeting, there might be some confusion of where that fits in the Department of Energy.

The Energy Information Administration was created as a semi-independent entity within the Department of Energy and is responsible both to the Secretary of Energy and to Congress. Its main task is to provide information on developments in energy markets, either current or prospectively, without any policy advocacy. We do not make policy. We do a lot of analysis of policy initiatives but in no way do we try to develop advocacy for a particular position. So what I present is a set of projections rooted in what we understand to be the current regimes of policy in the United States and elsewhere.

Three key propositions inform considerations regarding long-term energy market developments:

- The prospect for energy demand growth is substantial and will be based on fossil fuels.
- Growth will be centered in developing countries, particularly Asia, where living standards are rising.
- Thanks to technological know-how, resource availability will not constrain energy supply development.

In 1995, world energy consumption exceeded 360 quadrillion Btu's ("quads") or 8,500 million tons of oil equivalent ("MTOEs").<sup>1</sup> Fossil fuels provided eighty-five percent of world energy supply with oil the most important fuel followed by coal and natural gas. By 2015, in a reference or "Business as Usual" case, world consumption is expected to increase by 200 quads or 4,500 MTOEs. Anticipated growth in the next twenty years is expected to add to world energy requirements an amount

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1. Energy Information Administration, U.S. Department of Energy, *International Energy Outlook 1997*, DOE/EIA-O484(97) (April 1997).

roughly equal to total world energy use in 1970. Fossil fuels are still projected to supply more than eighty-five percent of energy needs in 2015. The role of oil is expected to diminish somewhat, but production will rise almost fifty percent with daily supply totaling nearly 105 mbd (compared to 69 mbd in 1995).

Amongst all fuels, natural gas use is expected to rise most rapidly, doubling over the next two decades. Non-fossil fuel use loses some share as nuclear energy supply diminishes, a result of market competition from natural gas, public concern about the safety of nuclear reactor operations, and problems associated with the disposal of nuclear waste, especially in the United States.

The regional composition of energy demand is undergoing dramatic change. Leading industrialized countries in North America, Western Europe, and Asia accounted for more than one half of world energy consumption in 1995. Their share will drop to about forty-six percent within the next two decades. By 2015, developing Asia, including especially China and India, will consume more energy than all of North America, and the level of energy consumption in developing Asia will exceed Western Europe levels by almost a factor of two. In 1995, consumption levels in these two regions were roughly equal.

Changes in relative levels of energy consumption will dramatically shift energy market trading patterns. Over the next twenty years, the volume of oil produced for export will rise from about forty-eight percent of total supply to nearly sixty percent. Whereas industrialized countries, including especially North America and Western Europe, are the largest importers of oil in 1995, by 2015, Asia Pacific countries, led by China, will come to play a major role in oil trade. China is likely to become the largest customer for Middle Eastern oil exports.

Many uncertainties attend long-term energy projections. Key among these are rates of economic growth and the relation of energy use to changing levels of economic welfare. In industrialized countries, projected economic growth is slower than that expected for emerging economies, especially in Asia and South America. Expected higher rates of growth in industrializing countries accounts in large part for their emergence as key consumers of energy. Were growth rates to falter, so too would increased need for energy supplies. Higher or lower growth

rates within the range of historic experience could affect world energy requirements by 100 quads or more (up or down) by 2015.

Another source of uncertainty is the relation of growth in energy use to overall growth in economic output. To what extent is energy growth coupled with growth in GDP? In general, industrialized countries have relatively low energy/GDP ratios. Higher income leads to expenditures which are not especially energy intensive. As income rises, goods purchases do not rise as rapidly as purchases of services. While energy use per capita is high relative to world standards, it is not increasing even as living standards rise.

In emerging economies, rising income usually means an at least proportional increase in energy consumption. Cars for personal transport, modern appliances for household services, larger homes with heat and air conditioning all have high income elasticity of demand. Thus, rising living standards and increased energy use go hand in hand.

In developing Asia, with a population of more than three billion people, energy use per capita is currently at low levels. However, use is rising more rapidly than in industrialized countries. Substantial variations in energy demand projections can arise from different views on rates of growth in per capita use. If future growth in oil demand in China and India were to match the historical rate for South Korea, their combined consumption in 2015 would be 45.5 mbd higher than projected in the reference case. In emerging economies, the forecast generally is for substantial increases in energy use per capita. However, at the end of the projection period, use per capita is still only a fraction of current use rates in developed countries. World demand for energy could be much higher by 2015 if growth in energy use per capita is under-predicted.

As noted at the outset, the energy projections presented here are developed in a business-as-usual context wherein existing energy policies are stable. Growing concerns regarding global warming is only one factor that could lead to important changes in policies throughout the world economy.

The projection presented was developed only a few years after the Framework Convention on Climate Change was adopted. More than 160 nations have endorsed the need to stabilize world

carbon emissions and yet this outlook depicts an energy world in 2015 which is fossil fuel-based, with worldwide emissions of carbon approaching ten billion metric tons — an increase of four billion tons relative to 1990 levels. Current trends in cost and availability favor continued and increasing use of carbon-based fuels. Compositional changes in supply will favor greater reliance on natural gas, which generates only half as much carbon per unit of heat as does coal. However, especially in Asia, the main fuel of choice will be coal. Thus, not only does economic growth dictate larger energy requirements in this region, but the energy requirements will be served by relatively high carbon emitting fuel sources. As a consequence, even if all industrialized countries were to achieve stabilization of carbon emissions at 1990 levels (a goal endorsed in the RIO treaty), emissions worldwide would rise by three billion tons over the next two decades and emerging economies would come to account for more than half of world emissions on an annual basis.

As the debate on climate change has intensified, some have suggested that resource depletion of oil and other fossil fuels could cause energy prices to escalate to a degree that energy demand growth could be checked or diverted to non-carbon energy sources. In the mid and late 1970s, it was easy to find public discussion and indeed many projections in which oil prices were escalating and encouraging a search for energy substitutes. Such discussions are now rare.

Most forecasts project relatively stable oil prices over the next ten to twenty years, even with large increases in overall demand. The *International Energy Outlook* projection has prices rising ten to fifteen percent per barrel by 2015, even while oil demand increases by more than fifty percent from current levels. This does not mean that no one expects sharp short-term oil price variations over the projection period. Events equivalent to the Gulf War or a coup which disrupts current production are likely to occur. However, over time, underlying production capabilities are likely to continue to evolve, which enable larger supplies of energy at relatively stable long term costs. We have to thank advances in technological capabilities to produce energy for the prospect of stable energy prices. We now know more about how to search for oil, how to extract it, even in very difficult producing environments, than we did a decade or more ago. As a consequence, prospective production capability is ris-

ing in all areas of the world. Even in the United States, with a very mature resource base, we have, in the past three years, lowered our price projection by nearly one third while not reducing expected levels of production. Production cost reductions, due to improved technology, have compensated for poorer oil price prospects.

In 1980, worldwide proven oil reserves were 655 billion barrels. By 1995, they exceeded 1017 billion barrels — an increase of fifty-five percent. At the same time, the price of oil in 1995 was only US\$17 compared to US\$60 in 1980 (in 1995 real dollars) and an average in excess of US\$40 between 1975 and 1985.

Lower price and higher production prospects for oil and other energy sources are not solely a product of technological advancement. Significant political change has evolved since the 1970s, which improve the economics of energy development even without technological change. Tax regimes have been moderated. Changes in political regimes have opened new areas to investment and development. However, the demonstration of technological potential in a wide variety of applications has helped spur political review and a search for policies that help assure competitive participation in evolving energy markets.