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Energy trade between Australia and Korea

Potential developments to 2010

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Australia and Korea have developed a close and mutually beneficial trading relationship founded on the natural complementarities of the two economies. Trade in energy — principally coal and oil — has been an important component of this relationship. As a resource poor economy, Korea's growing energy demand has been met almost exclusively by imports. Reflecting its competitiveness as an energy exporter, Australia has supplied a large proportion of this demand.

A number of factors will influence this relationship over the coming decade. These include rates of growth in Korea's energy demand and the continuing competitiveness of Australia's energy exports. Also important will be policy developments in Korea, such as the deregulation of the electricity supply industry, that are likely to affect the energy demand profile.

The objective in this paper is to examine likely developments in the energy trade relationship between Korea and Australia. ABARE's global trade and environment model (GTEM) is used to develop a reference case or a 'business as usual' simulation of Korea's energy demand and trade. It is also used to analyse the potential impacts of electricity sector deregulation.

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Trade between Australia and the Republic of Korea has expanded rapidly over the past decade. In 1990, the value of bilateral trade was over A$4 billion. This grew on average by 14 per cent a year to reach approximately A$13 billion in 2000. Korea was Australia's fifth largest trading partner in that year and Australia ranked eighth in Korea's total trade.

The growth in bilateral trade has been driven by the natural complementarities between the two economies, with energy playing a major role in the trade structure. Korea's rapid industrialisation and high rates of economic growth since the mid-1980s have been underpinned by strong increases in energy consumption. As an energy resource poor economy, Korea's energy demand has been met almost exclusively by imports. Reflecting its competitiveness as an energy exporter, Australia has supplied a large proportion of this demand.

The objective in this paper is to examine recent trends in the energy trade relationship between Australia and Korea and to explore some of the factors that are likely to influence the direction of this relationship over the coming decade. Specifically, prospects for the deregulation of Korea's electricity industry over the period to 2010 will be examined. The assessment of the impacts of this policy change is based on applications of ABARE's global trade and environment model (GTEM). The key characteristics of GTEM are summarised in box 1.

Box 1: **Global trade and environment model (GTEM)**

GTEM is a dynamic general equilibrium model of the world economy developed at ABARE to address economic and policy issues with global dimensions. GTEM is suitable for analysing the impacts of policies such as electricity sector deregulation because of its detailed coverage of regions, countries and sectors. This includes detailed representation of the economy and energy sectors in Korea and Australia. GTEM is able to cover the impacts of policy and other changes on a large number of economic variables including prices, output, and trade and investment flows between countries and regions. Energy modeling features of GTEM include fuel switching in electricity generation and differentiated supply responses in fossil fuel markets.

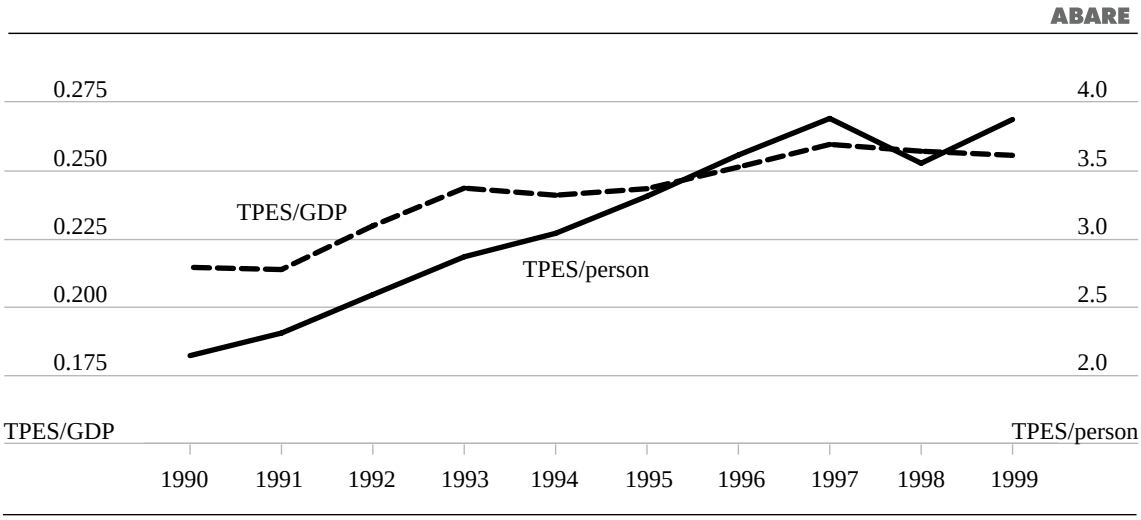
For a detailed description of the features of the model, refer to ABARE's web site:
www.abareconomics.com

Energy trade between Australia and Korea

Throughout the 1990s, Korea's economy grew on average by more than 7 per cent a year, underpinned by open trade and investment policies. Economic growth has been accompanied by rapid increases in energy consumption and in the energy intensity of economic output (figure 1).

Oil continues to account for the largest share of primary energy consumption, driven by strong demand growth in the transport and industry sectors. Consumption of gas and nuclear power has grown more strongly than that of other fuels, however, as the government has sought to diversify the fuel mix (figure 2).

Figure 1: **Energy intensity and energy consumption per person, Republic of Korea**



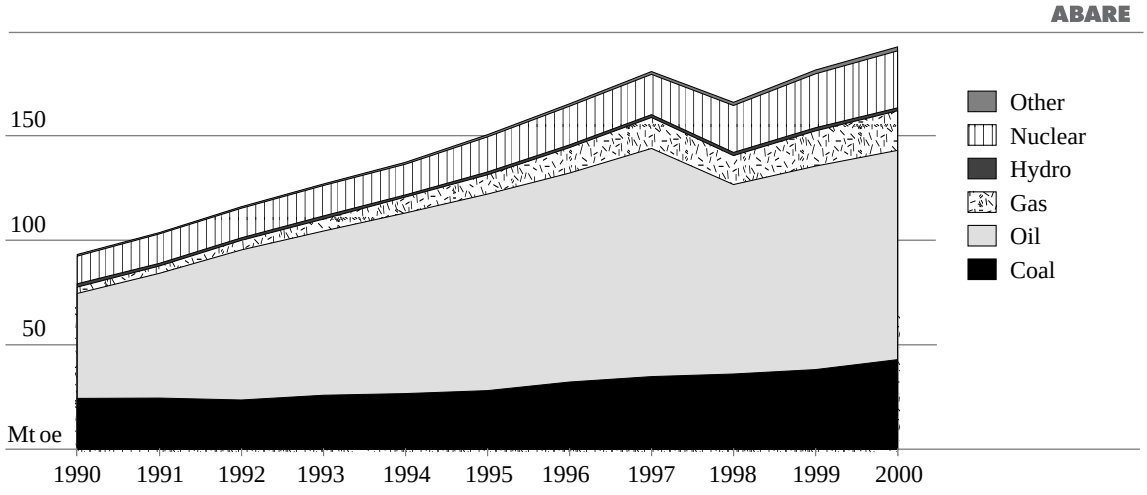
TPES/GDP = tonnes of oil equivalent per 1995 $'000 purchasing power parity.
TPES/population = tonnes of oil equivalent per person.
Source: IEA (2001).

Apart from a small amount of domestically produced coal, all Korea's fossil fuel demand is met by imports. As an internationally competitive energy producer and exporter, Australia has been well positioned to meet Korea's energy demand. Fossil fuels have accounted for a significant proportion of Australia's total exports to Korea (figure 3).

Coal

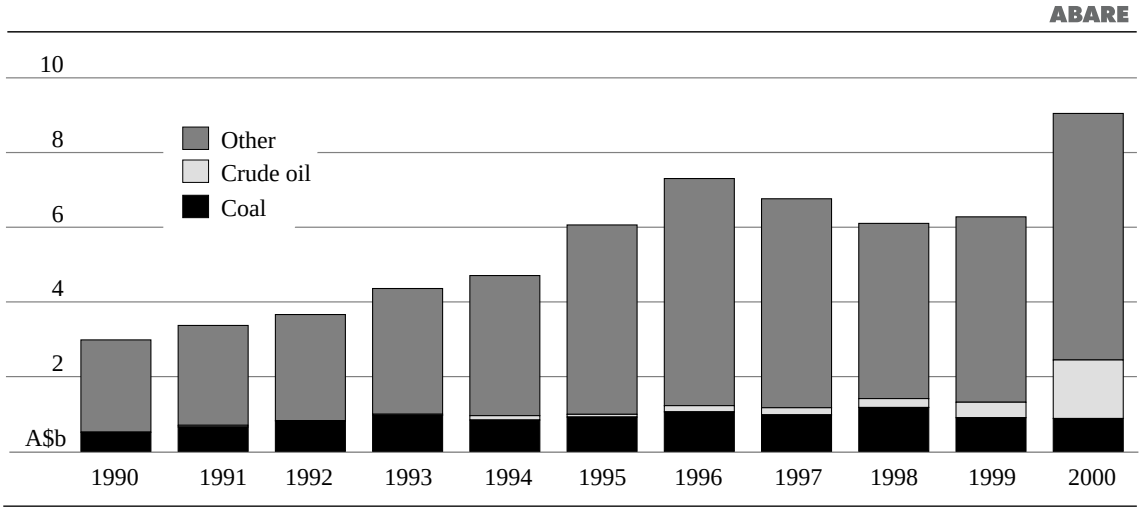
As a result of the rapid expansion in power generation and iron and steel production in Korea, coal has become the most important energy commodity in the bilateral trade relationship. In 2000, Australia exported 11.6 million tonnes of steaming coal to Korea, primarily for use in power generation (figure 4). However, this is well below the 1998 figure of 15.7 million tonnes as some Australian exports have been displaced by rapid growth in

Figure 2: **Total primary energy consumption, by fuel, Republic of Korea**



Source: KEEI (2001).

Figure 3: **Australian exports to the Republic of Korea**

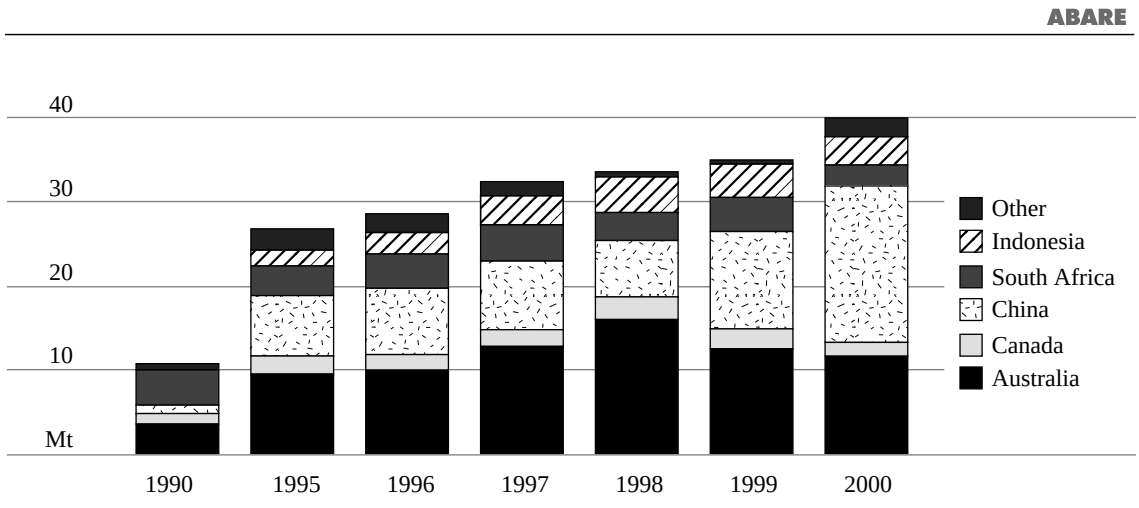


Source: DFAT (2001).
Note: Value of LNG and uranium exports is confidential and is included in 'other' exports. Oil products, including liquefied petroleum gas (LPG), also fall within this category.

coal exports from China. Indeed in 2000, China surpassed Australia as the largest supplier of steaming coal to Korea. Korea remains Australia's second largest steaming coal export market after Japan.

Australia has also been the largest supplier of coking coal to Korea for use in the iron and steel industry. In 2000, Australian exports to Korea were 10.5 million tonnes, or 54 per cent of Korea's total coking coal imports (figure 5). Chinese exports of coking coal have also increased their share of Korea's market but have made less impact than in the steaming coal sector. Korea remains Australia's second largest coking coal export market after Japan.

Figure 4: **Korea's steaming coal imports, by origin**



Sources: IEA (2000a); International Coal Report (2001).

Figure 5: **Korea's coking coal imports, by origin**

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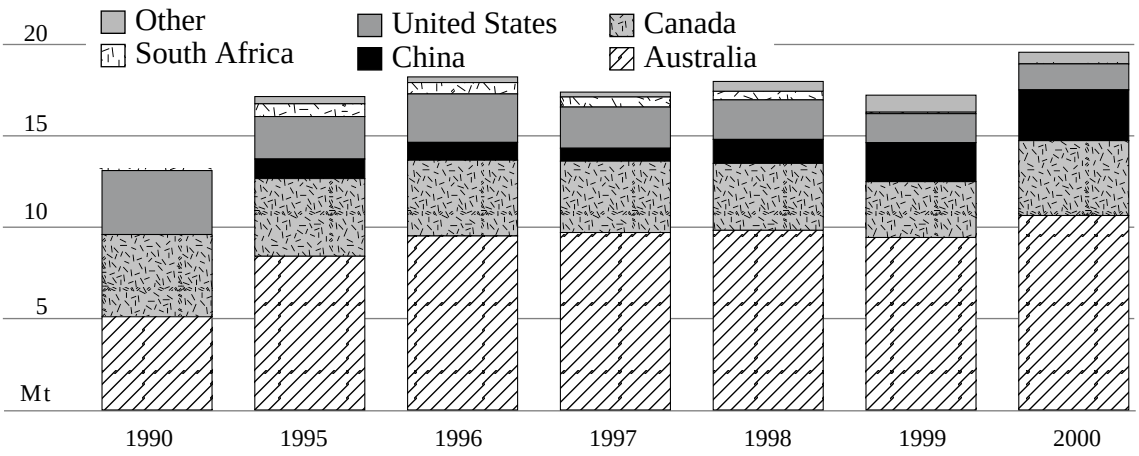

Sources: IEA (2000a); International Coal Report (2001).

As well as the trade dimension, there is increasing investment in Australia's coal sector by Korean interests. Investment is concentrated mainly in steaming coal projects and Korean parties hold varying shares in nine Australian coal mines. This is consistent with the Korean government's policy of sourcing 30 per cent of its coal from overseas projects involving Korean interests by 2006 (DISR 2001).

Petroleum

Crude oil and petroleum products have not been a significant aspect of the trade relationship from the Korean perspective as the majority of Korea's oil imports are from the Middle East. From the Australian perspective, however, the trade is substantial. In 1999, Australia exported 2.1 million tonnes of crude oil to Korea. This represented 22 per cent of total

Figure 6: **Korea's crude oil imports, by origin, 1999**

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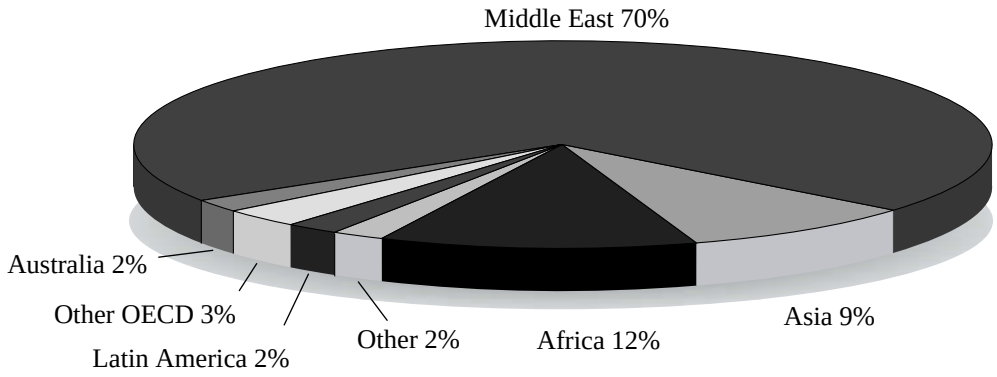


Source: IEA (2000b).

Australian crude oil exports, but only 2 per cent of Korea's crude imports (figure 6). A similar picture is reflected in petroleum products, especially liquefied petroleum gas (LPG). In 1999, Korea imported 78 000 tonnes of Australian LPG. Korea was Australia's second largest LPG export market, but Australian LPG comprised less than 2 per cent of Korea's total LPG imports.

Korean interests also hold a 10 per cent share in each of four Australian petroleum export permits (DISR 2001).

Liquefied natural gas

To address environmental concerns and diversify the fuel mix, Korea has increased its consumption of natural gas over the past decade. In 2000, gas accounted for 10 per cent of primary energy supply and 9 per cent of electricity generation. With no economically viable domestic gas reserves and no transnational pipeline infrastructure connecting Korea with foreign supply sources, all gas is imported as liquefied natural gas (LNG).

Australia is a major LNG producer and Korea a major LNG buyer, yet bilateral LNG trade has been limited to six Korean purchases of Australian LNG on the spot market — the first in 1993 and the latest in 2001. Korea obtains over 90 per cent of its LNG through supply contracts with Indonesia and Malaysia. There are significant plans to increase domestic gas consumption in Korea, which, if implemented, would require an expansion in LNG imports. This represents a significant potential export opportunity for the Australian LNG industry.

Uranium

Nuclear power generation provides more than 40 per cent of Korea's electricity output, making Korea an important market for uranium exporters such as Australia. In 2000, Australia exported 700 tonnes of uranium oxide (U_3O_8) to Korea. This represented 16 per cent of Korea's total uranium oxide imports and 8 per cent of Australia's exports. Planned expansion of nuclear power generation can be expected to provide further opportunity for Australian uranium exporters.

Future developments in the energy trade relationship

Because of Korea's dependence on imported energy, the development of the energy trade relationship between Australia and Korea will depend primarily on growth in Korea's energy demand and on the continuing competitiveness of Australia's energy exports. Korea's energy demand will be related strongly to rates of economic growth, patterns of industrial development and structural change in the economy, as well as the rate of increase

in the consumption of energy services (such as transport, space heating and electrical appliances) that accompanies rising per person incomes.

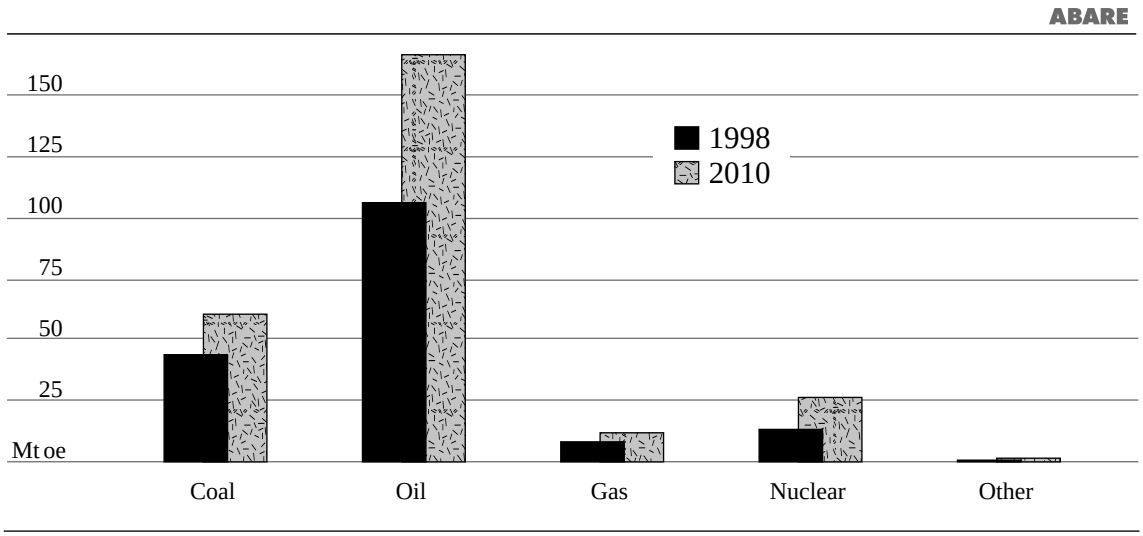
There are also a number of policy issues that could affect the outlook for energy consumption. On the domestic side, these include the deregulation of Korea's electricity sector that is currently being implemented. International policy responses to global climate change could also have implications for the Korean energy sector even though under the current international negotiating framework Korea is not obliged to undertake any action to reduce its emissions of greenhouse gases. In this paper only the impacts of electricity sector deregulation are considered.

ABARE's global trade and environment model (GTEM) is used to develop a reference case or a 'business as usual' simulation of Korea's energy consumption and trade over the period to 2010. The reference case projects the growth in key variables in Korea in the absence of any significant policy changes such as those proposed in the electricity sector. The impacts of electricity sector deregulation are then analysed. The results from the policy simulation are interpreted as deviations from the reference case.

Reference case projections

In the reference case, Korea's gross domestic product (GDP) is assumed to grow at an average rate of 5.3 per cent a year. Total primary energy consumption is projected to expand at 3.4 per cent a year to reach 267 million tonnes of oil equivalent by 2010. This compares with 165 million tonnes of oil equivalent in 1998. Given the GDP growth assumption, this implies a considerable reduction in energy intensity in Korea over the period and reflects an ongoing shift in the structure of economic output toward the services sector, as well as improvements in energy efficiency. The reference case projects that coal and oil continue to dominate the fuel structure in 2010 (figure 7).

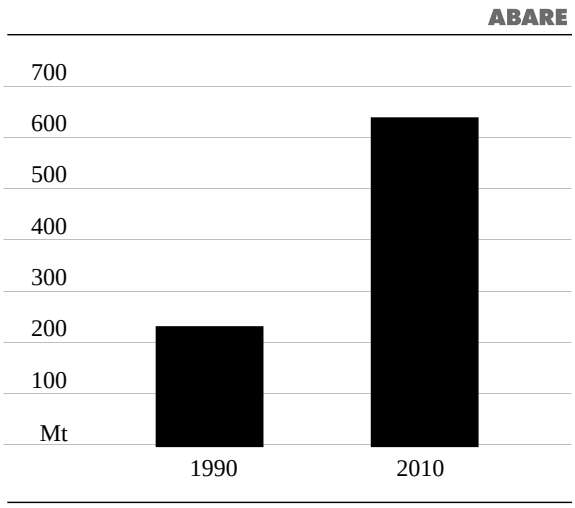
Figure 7: **Total primary energy consumption, by fuel**



In the reference case, total electricity output is projected to expand at 3.8 per cent a year to reach 355 terawatt hours in 2010. Coal and nuclear power are projected to remain the dominant fuels for power generation.

Korea's increased demand for fossil fuels over the projection period leads to higher greenhouse gas emissions of 640 million tonnes of carbon equivalent in 2010. This represents an annual growth rate of 4.2 per cent over the 1990 level (figure 8).

Figure 8: **Korea's carbon emissions**



Under the reference case, imports continue to meet the bulk of Korea's fossil fuel requirements. Korea's steaming coal imports from Australia are projected to rise from 12.4 million tonnes in 1999 to 19.2 million tonnes in 2010. Over the same period, imports of Australian coking coal rise from 9.4 million tonnes to 13.2 million tonnes, and oil imports rise marginally from 2.1 million tonnes to 2.2 million tonnes.

Impacts of electricity sector deregulation

As in many economies, a key energy policy priority in Korea is improving the efficiency of the electricity supply industry. To date, Korea's electricity industry has been dominated by the Korea Electric Power Corporation (KEPCO) that operates around 85 per cent of the country's generating capacity and has monopoly roles in transmission, purchasing and distribution (World Energy Council 2001).

The first element of competition was introduced into the electricity system with the entry of independent power producers in the 1980s. It was not until the late 1990s, however, that Korea developed a comprehensive plan to restructure and privatise the electricity industry. The objectives of the reform program are to increase the efficiency of the power sector by establishing a competitive market structure; to effectively finance future generation capacity; and to expand the range of services and benefits to customers.

Competition is being introduced into the generation sector through the restructuring of KEPCO's generation assets into individual companies and their eventual privatisation. The transmission system will continue to be owned by KEPCO but the monopoly element of the network will be reduced by ensuring open access to the grid. Similar changes are proposed for the distribution sector although KEPCO's distribution assets will be privatised. Full retail contestability will be introduced at the end point of the reform program

and independent regulatory arrangements will be introduced to manage different aspects of the system.

A more competitive electricity industry in Korea could have implications for energy markets and for the economy more broadly. This is because competition in electricity supply is expected to lead to increased productivity in the industry, contributing to lower costs of electricity supply. Because electricity is an important input to economic activity, the lower electricity prices that may result from productivity improvements could provide a significant productivity boost to the economy and lead to higher economic growth. This, in turn, will have implications for the level of energy consumption. Increased competition in the electricity market could also influence the mix of fuels used in power generation because it will tend to increase the pressure on fuel prices and to favor the lowest cost generation technologies.

In the simulation, Korea's deregulation of the electricity industry is assumed to boost productivity in the sector by around 1.3 per cent a year and to lead to reductions in the price of electricity to industrial and commercial users of 9 per cent over the period from 2002 to 2010. This reflects estimates from the Korea Institute for Industrial Economies and Trade (KIET 1999) of the macroeconomic impacts of regulatory reform in the electricity industry. The price impacts on the household sector are limited to 3.5 per cent over the same period because full retail contestability is not expected until the final stages of reform.

Macroeconomic impacts

As a result of lower electricity prices following deregulation, total demand for goods and services expands in Korea relative to the reference case. This results in GDP rising by 0.3 per cent above reference case levels at 2010. Underlying the increase in GDP are improvements in the competitiveness of industrial and commercial output that result from lower electricity prices.

Sectoral impacts

When the price of electricity falls following deregulation, the competitiveness of Korea's electricity intensive sectors improves relative to other sectors of the economy and relative to energy intensive production in other economies. As a result, the output of these industries rises above their reference case levels (figure 9). Together, electricity intensive industries account for a larger share of economic output than in the reference case.

The net effect of these structural impacts following deregulation is that economic activity in Korea at 2010 is more electricity intensive than in the reference case (figure 10). That is, the price and other impacts of deregulation mean that more electricity is used to

Figure 9: **Impacts of deregulation on sectoral output, 2010**
Relative to the reference case

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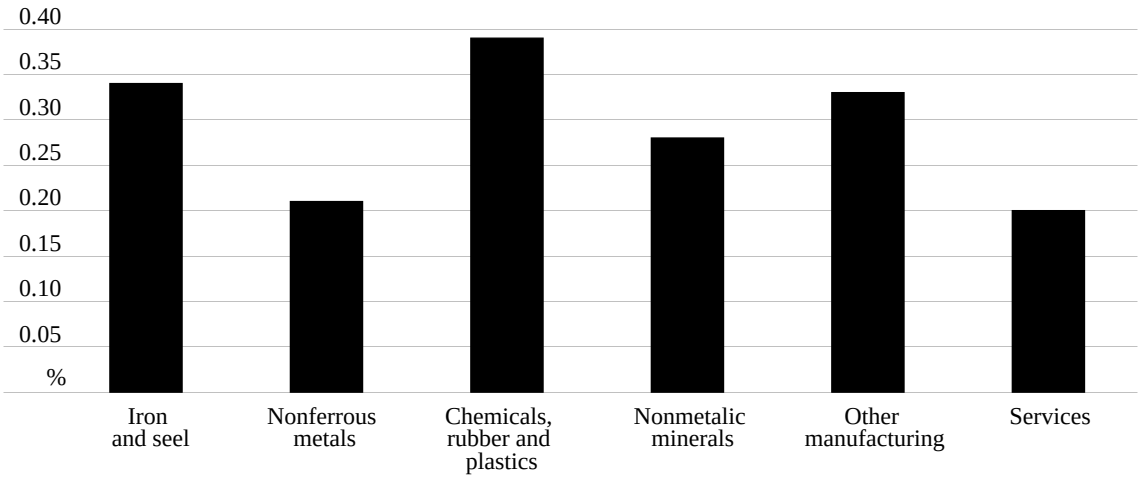

produce a given amount of GDP after deregulation than in the reference case situation.

Figure 10: **Impacts of deregulation on electricity output and electricity intensity, 2010**
Relative to the reference case

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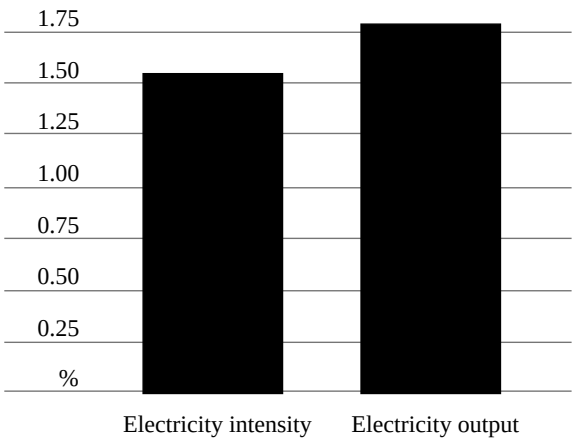

Given the increases in economic output and in electricity intensity, it follows that electricity demand in Korea is higher after deregulation than in the reference case. Electricity generation rises to 362 terawatt hours in 2010 or 1.7 per cent above its reference case level. There is also some shift in fuel shares at 2010 because of the increasing pressure on generators to reduce costs. In the current environment, coal fired electricity generation technologies are the most cost effective. The results indicate that, following deregulation, there is a small movement in fuel shares at 2010 compared with the reference case away from oil and toward coal and gas fired power.

Impacts on fossil fuel imports

The combined impacts of the growth in economic output, structural shifts toward electricity intensive activities and changes in the electricity fuel mix that follow deregulation result in increased demand for coal and gas in Korea relative to the reference case (figure 11). And because Korea has no significant domestic energy resources, this translates into higher imports at 2010 relative to reference case levels.

Figure 11: **Impacts of deregulation on energy imports, 2010**
Relative to the reference case

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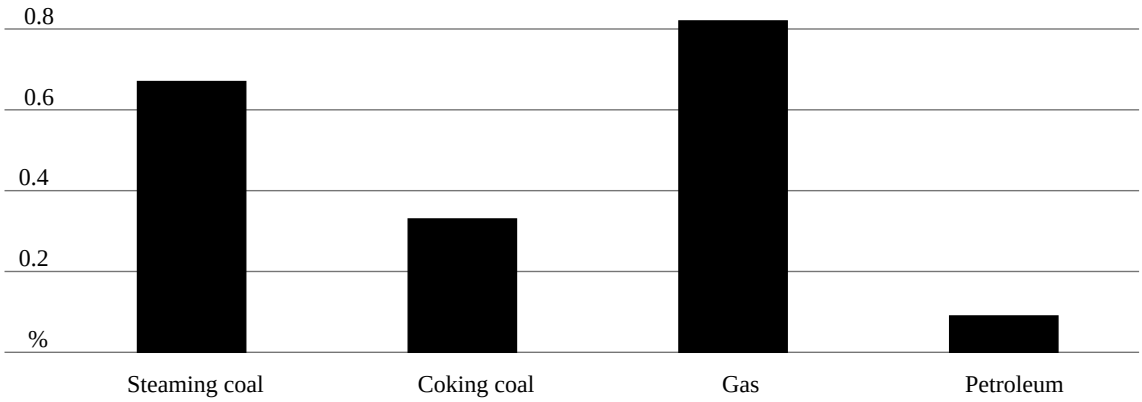

The simulation results indicate that Australian steaming coal exports to Korea in 2010 are around 1 per cent higher than in the reference case. This reflects the current and expected competitiveness of the Australian export steaming coal industry. Australia does not yet export gas to Korea in meaningful quantities and the modeling is not structured to capture the potential to break into this possibly significant market. However, given that Korea's gas demand growth is projected to be stronger following deregulation than before, it represents an important market opportunity for the Australian LNG industry.

Conclusions

Australia and Korea have developed a close trading relationship founded on the natural complementarities of the two economies. An important component of this relationship has been Korea's demand for fossil fuels and the ability of competitive Australian exporters, particularly in the coal industry, to meet this demand.

Over the next decade this relationship will be affected by factors such as deregulation of the Korean electricity sector. As results from GTEM illustrate, such changes could result in increased Korean fossil fuel demand. This should provide enhanced export opportunities for Australian coal and gas exporters provided they remain price competitive with other sellers to the Korean market.

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