

The progress made by Korea, the IEA's most recent member, over the last decades is nothing short of remarkable. Faced with phenomenal economic growth, the country's energy infrastructure has not only kept pace, but has also allowed Korea to maintain this growth. In recent years, as growth has stabilised towards more sustainable levels, the country has continued to thrive, particularly in the face of a changing world energy market and increased environmental concerns. As a result of this evolving environment, Korea's energy policy perspective has also changed. The government has expanded its focus from just security of supply at all costs to also encompass economic efficiency and environmental protection. As this expanded set of policy objectives matches the 3 Es of the IEA's agreed goals – energy security of supply, economic efficiency and environmental protection – the IEA applauds Korea's efforts and accomplishments. As in all IEA countries, more can be done to improve energy policies and programmes in Korea to help better achieve these three goals, but the sound framework already in place is impressive.

## **LIBERALISATION AND ENERGY MARKET REFORM**

Perhaps the greatest challenge facing the Korean government regarding its energy policy is the lack of a clear, long-term vision for its energy markets. Although Korea was strongly committed to liberalisation of its natural gas and electricity markets, world events such as blackouts and higher prices have coupled with domestic realities to feed entrenched special interests and scepticism about the benefits of liberalisation. This has left Korea in a precarious situation. Plans for liberalisation have been stalled and gas and electricity industries are now stuck half-way between regulated vertical integration and competitive markets, to the detriment of these industries and, ultimately, the Korean customer. There are gains to be made from pressing forward with liberalisation and dangers from remaining at the crossroads. While the Korean economy to date has experienced tremendous growth, necessitating a constantly expanding energy infrastructure, the transition to lower, less predictable growth is better matched with the flexible, responsive and efficient energy system that a liberalised market can help deliver. Moreover, the lack of a clear framework for the future of Korea's gas and electricity industries adds uncertainty to the markets, undermining efficient outcomes in terms of infrastructure investments, security of supply and overall energy costs. In particular, there are concerns that the lack of a clear and comprehensive reform plan has inhibited long-term contracting for natural gas supplies.

The IEA therefore encourages Korea to set out a clear plan – with milestones and dates – for reform of its gas and electricity markets that includes the necessary ingredients for successful liberalisation. Critical to this reform process are several specific milestones, namely the establishment of a fully independent and powerful gas and power regulator; the elimination of prescriptive government planning; effective unbundling of transmission and distribution from generation and retail; a fully independent system operator; institution of effective open access on the transmission system; the establishment of market-based trading arrangements for wholesale power; removal of policies that inhibit activity from independent power producers; and the establishment of a plan for retail contestability, at least for industrial customers. An entirely separate issue is the privatisation of energy assets. Although privatisation can bring important additional benefits, it is not a critical component for liberalisation and does not need to be undertaken early in the process. It is quite possible to press forward with liberalisation while at the same time stalling privatisation. The establishment of a credible and powerful regulator is the most important first step in order to reassure market participants that the liberalised market will be monitored impartially and consistently, particularly in a situation where many assets remain state-owned.

In addition to codifying a reform plan for Korea's gas and electricity markets, the government should establish a comprehensive and co-ordinated energy strategy, and a framework that involves all stakeholders, improves co-ordination across different ministries and government entities, integrates the environmental dimensions of energy consumption into energy policy, introduces more checks and balances and enhances transparency of the policy-making process. Taken together, this would allow Korea to have a better aligned energy policy, so that different government agencies are better able to co-operate and energy policy objectives are met through effective programme implementation in all parts of the government. While Korea is working to improve policy transparency and co-ordination, particularly with respect to environmental policy, the IEA encourages the government to strengthen its efforts.

## **CLIMATE CHANGE, ENVIRONMENT AND EFFICIENCY**

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Korea is working to improve energy efficiency and lower the growth of greenhouse gas emissions, but it has not taken on any binding emissions targets under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Given the country's current level of economic development – it now has a GDP per capita above some other IEA countries – the country should consider setting out climate change-specific targets and

objectives. The rapid growth of Korea's emissions – emissions are projected to grow by 70% between 2000 and 2030 – makes setting such targets and objectives vital. Critical to limiting greenhouse gas emissions growth in the most cost-effective manner is putting a price on carbon, either in the form of a direct tax or through an emissions trading scheme where the market determines the price. Korea should ensure that greenhouse gas targets are met through flexible market-based mechanisms to make the process as dynamic and transparent as possible.

Though many other factors affect air quality, energy-related emissions, primarily from power plants and transport sources, are a major source of air pollution. Air quality in Korea is generally poor in most of its large cities, particularly Seoul, in comparison to other OECD countries. The government is therefore commended for establishing ambient air quality standards, which will help improve air quality, as well as the quality of life for Korean citizens. The government should continue to monitor these standards, and ensure that they are enforced. If necessary, stronger measures or other policies, including an emissions trading scheme, should be considered.

Improved energy efficiency has much to offer Korea. The country has relatively low energy efficiency, owing in part to its rapid development and its heavy industrial base, and although declining, energy intensity is expected to remain high. Improved efficiency could lower total energy costs, enhance energy security by lowering overall energy import needs and reduce greenhouse gas emissions. The IEA commends Korea's three-year plan to improve the overall efficiency of the country by 2007. However, as Korea's energy consumption is growing rapidly, the savings stemming from efficiency will have a relatively small impact on total consumption, which will still be 15% higher in 2007 than in 2003. The IEA encourages Korea to consider setting more ambitious efficiency targets, particularly in the transport and residential sectors. To that end, the new long-term 2020 efficiency goals for the transport and building sectors are a good first step in strengthening these targets.

The IEA applauds Korea's performance in two areas related to energy efficiency, namely fuel economy and standby power appliance standards. Korea has introduced fuel economy standards for the first time, a critical step given the country's rapidly growing car fleet. The IEA encourages Korea to monitor these standards, ensure compliance with them and establish a clear timetable for implementing more stringent standards in the future, keeping its standards in line with world best practice. With respect to appliance standards, Korea's initiative to limit standby power to one watt through the Standby Korea 2010 programme is the first implementation of the IEA's 1-watt initiative in the world and, as such, is a model for other countries. We encourage the government to work to merge

its standby standards with overall energy performance standards, reducing the administrative and regulatory burden for companies and the government, which now administer two sets of standards independently. Korea's efforts to improve the efficiency of vehicles and appliances are notable not only because of their strong effect on domestic energy efficiency, but also because, as a net exporter of these products, Korea's policies will benefit global energy efficiency. Furthermore, the vast and growing public transit network in Seoul and other Korean cities is a model for other countries, particularly as evidenced by the very high public transit usage rates.

The share of new and renewable energy sources in Korea's overall energy mix is the lowest of all IEA countries – 2.1% of total primary energy supply in 2004. Korea's targets to raise this level to 3% in 2006 and 5% in 2011 are therefore welcome. However, Korea is unlikely to meet its 2006 goal, which makes strengthening policies critical to meeting the 2011 target. To ensure the 2011 target is met, the IEA encourages the government to set a detailed timetable and monitor progress so that any necessary policy modifications can be made as quickly as possible. We also encourage the government to set a cost-effective biofuels target and put in place a flexible means of achieving the target, as this would help increase renewable energy and reduce reliance on imported oil.

One means of improving the effectiveness of policies to increase new and renewable energy deployment is by conducting more rigorous cost-benefit analysis of policies, particularly in light of long-term targets. For example, Korea's current plan provides the greatest share of funding for photovoltaics and hydrogen fuel cells, although these technologies are forecast to contribute a small share of the total new and renewable energy in the medium term. Moreover, the government's reliance on a differentiated feed-in tariff, where specific technologies are given guaranteed energy prices, may raise the overall cost of the programme. For example, solar photovoltaics receive a feed-in tariff that is more than six times that of wind. While the government provides this preferential support to develop a long-term solar photovoltaics export market, the risk is that the government is only raising the overall cost of supporting renewable energy development, and developing an industry with artificial and, therefore, unsustainable economics. The government should outline feed-in tariff levels for the long term, and consider lowering differentials in feed-in tariffs over time to avoid creating entrenched and hard-to-remove subsidies for particular technologies. In addition, the government should consider replacing feed-in tariffs with more market-based alternatives, such as a green certificate scheme. This cost-effect approach continues to promote renewables and reflect the costs of environmental externalities, but allows support levels to adapt to market conditions instead of guaranteeing a fixed and permanent subsidy.

## ENERGY PRICING

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Cost-reflective pricing can be the most effective means of spurring efficiency. However, in Korea, certain classes of customers, namely industrial and agricultural customers, pay energy prices that are below cost. Furthermore, subsidies are provided to domestic coal producers and consumers. This encourages inefficient consumption of resources and raises the total cost of energy for Korean customers. With respect to coal subsidies, which help maintain domestic production as a means of assuring security of supply, the lack of good-quality coal resources in Korea and the abundance of coal from diverse sources on the world market make this a very costly policy, especially considering the small volume of coal actually produced. Throughout its energy system, Korea should remove all subsidies – both to particular customer classes and across fuels – and let prices reflect true costs. This will necessitate strong political will on the part of the government, but is necessary to underpin an energy system that provides stable supply at the lowest cost over the long term.

In the electricity and gas markets, expansion of time-of-use and, preferably, real-time pricing could help lower costs and enhance security. In electricity markets, the electricity company, KEPCO, has installed advanced meters at many locations. We encourage the government to take advantage of this investment, and help design the market so that real-time pricing can be offered to as many customer classes as possible, including all industrial customers. In the gas market, Korea's seasonality of demand is a cause for concern; around four times more gas is used in the winter than in the summer, largely as a result of space heating demand. This leads to higher gas procurement costs, as producers of liquefied natural gas – which supplies nearly all of Korea's demand – supply steady off-take of natural gas through long-term contracts. Korea is working to estimate the higher actual costs and reflect them in customer pricing through surcharges. While we commend this strategy, we also encourage the government to move from estimated and administratively set price signals to a market design that allows end-use customers to see true time-varying supply costs. Such transparency would help lower overall costs as many customers could shift lower-value consumption to lower-cost periods.

## OIL MARKET

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Korea's oil industry has been liberalised since the 1990s and the country is now a major exporter of crude products. Although oil still makes up a relatively large share of Korea's energy use compared to most countries, particularly in the industrial sector, Korea has successfully diversified its fuels and fuel sources. With respect to the oil market, we encourage the government to continue to monitor the sector carefully and, if necessary, strengthen efforts

to prevent and penalise anti-competitive behaviour. One key area of concern is the differentiated import taxes for crude oil and oil products, which give preferential treatment to Korea's large refineries at the expense of domestic product importers. The government should remove these differentiated import tax rates. With respect to its oil stockholding obligation, the IEA applauds Korea's strong commitment; its reserves have never fallen below the 90-day net import obligation and reserves are currently well above the minimum level. To ensure ongoing compliance, the government should continue to monitor its oil loan programme so that the loans do not result in Korea's stocks falling below the 90-day level and that any effects on stock levels stemming from the loans are reflected in data submitted to the IEA in a timely and transparent manner. Most importantly, the government should ensure that loans are made solely to mitigate unexpected supply disruptions, and only under fair and transparent terms to all market participants.

## **UPSTREAM GOVERNMENT INVESTMENTS IN FOSSIL FUELS DEVELOPMENT**

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Korea relies heavily on imports to meet its energy needs, given that it has no oil reserves, a very small amount of natural gas and some low-quality coal reserves. As part of its strategy to ensure security of supply, the government has been investing in upstream development of fossil fuels, although private companies play a more leading role in upstream activities. Nevertheless, as international resource development is highly competitive and not without risk, the government should consider leaving these investment decisions to private-sector Korean companies that also value security of supply and may be better equipped to make these complex investment decisions.

## **NUCLEAR INDUSTRY**

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Despite the relative youth of Korea's nuclear industry, it is a model for other countries. The government has put in place a comprehensive regulatory framework and the industry has an excellent safety record. Furthermore, nuclear plants in Korea have an average capacity factor above 90%, which is well above the world average of less than 80%. In recent years, Korea's most notable achievement has been the selection of a site for a low- and medium-level waste disposal facility. After incorporating lessons from previous unsuccessful site selection processes in Korea, the government put in place a world class site selection process that was transparent, fair and democratic. It also provided regulatory certainty and economic incentives. Korea has developed a process that can serve as a model for other countries, an achievement the IEA applauds. We encourage the government to expand on this success in two ways. First, we encourage the government to set up a

process for selection of a high-level waste disposal facility. Although this is not an immediate concern, world experience demonstrates that selecting a high-level waste disposal facility is a very long process. Second, we encourage the government to apply the transparent, fair and democratic nature of the site selection process to Korea's overall nuclear industry, helping to inform all government decisions. Korea's nuclear industry will continue to thrive if all stakeholders are part of a transparent and open dialogue. Going forward, we also encourage Korea to pay close attention to the funding and monitoring mechanism for the financing of decommissioning. In addition, we encourage the government to ensure that the nuclear safety regulator continues to be fair and independent.

## RESEARCH AND DEVELOPMENT

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In a time of falling R&D budgets, the IEA applauds Korea's rising budget for energy R&D. Korea should also be commended for its commitment to international co-operation and its recent explicit linking of its R&D funding framework with its overall energy policy goals. This will help better ensure that Korea's long-term policy goals are met. As Korea continues to develop its R&D funding framework, the IEA encourages the country to make cost-effectiveness a key criterion for project selection in most cases; to fund a handful of risky projects that could have a high payoff; to better incorporate environmental goals in the project-selection process; to fund research that looks at Korea's domestic resources of wind, biomass, geothermal, ocean and coal-bed methane; and to conduct research on international experience with the energy market liberalisation process.

## RECOMMENDATIONS

*The government of Korea should:*

### **General Energy Policy**

- ▶ *Continue to diversify energy supply and curb oil dependence, in part through enhanced energy efficiency policies and improved policy co-ordination.*
- ▶ *Re-launch energy market reform in electricity and gas markets, noting that liberalisation does not require privatisation.*
- ▶ *Establish independent electricity and gas market regulators with powers and responsibilities consistent with best practices of IEA countries. In particular, ensure that the regulator monitors third-party access to network*

*infrastructure and has the power to penalise operators who do not comply with the terms.*

- ▶ *Introduce more checks and balances – including transparent policy processes that involve all stakeholders – in energy policy at all its stages.*
- ▶ *Improve co-ordination and communication between the Ministry of Commerce, Industry and Energy; the Ministry of Environment; the Ministry of Finance and Economy; the Ministry of Construction and Transportation; and other relevant bodies, to ensure that all energy-related government policies are consistent.*
- ▶ *Integrate the environmental dimensions of energy production and consumption into energy policy in a systematic way. Implement market-based mechanisms (e.g. carbon taxes and/or emissions trading) to provide a CO<sub>2</sub> price signal.*

## **Energy and the Environment**

- ▶ *Set out climate change-specific targets and objectives and precise measures that are to be taken over the next few years to reduce the rate of growth of greenhouse gas emissions in order to participate actively in the United Nations Framework Convention on Climate Change process.*
- ▶ *Strengthen CO<sub>2</sub> mitigation measures, monitor all measures to ensure effective implementation and consider using an emissions trading system consistent with international trading systems, and/or a CO<sub>2</sub> tax.*
- ▶ *Continue to strengthen bilateral and multilateral co-operation in enhancing global efforts to tackle climate change.*
- ▶ *Assess the effectiveness of existing policy measures intended to improve air quality in all metropolitan areas and strengthen them if necessary. Use market-based mechanisms to internalise environmental costs.*
- ▶ *Continue to ensure that emissions of regional pollutants from coal-fired power plants are and remain in line with best-performing IEA countries.*

## **Energy Efficiency**

- ▶ *Consider setting more ambitious energy efficiency targets and timetables in light of the country's rapidly growing energy use, particularly in the transport and building sectors; monitor these targets and timetables to ensure that they are met.*
- ▶ *Ensure that energy prices in all sectors reflect costs and eliminate any subsidies.*

- ▶ *Monitor compliance with vehicle fuel economy standards; ensure that fuel economy standards remain in line with best practices of IEA countries and, as quickly as possible, set a timetable for progressively tightening these standards.*
- ▶ *Monitor voluntary agreements to ensure they achieve the expected targets; if they are not being met, consider enhanced or alternative policies.*
- ▶ *Evaluate current efficiency standards for buildings and make sure that they are and remain consistent with best practices of IEA countries with a similar climate. Strengthen enforcement if necessary.*
- ▶ *Consider merging standby energy performance standards with overall energy performance standards for major appliances to reduce the regulatory and administrative burden of the policy.*

## **New and Renewable Energy**

- ▶ *Set interim milestones and monitor progress towards meeting existing goals for the penetration of new and renewable energy, and revise or enhance policies and measures if milestones are not being met.*
- ▶ *Ensure a co-ordinated and comprehensive policy for renewables support; ensure that there is co-ordination and communication across government ministries and other entities.*
- ▶ *Evaluate all renewables promotion policies (e.g. differentiated feed-in tariffs) and select those that maximise cost-effectiveness.*
- ▶ *Outline feed-in tariff levels for the long term; consider lowering differentials in feed-in tariffs over time to reflect the technology learning curve and avoid entrenched oversubsidisation.*
- ▶ *Establish a realistic biofuels target and implement a comprehensive strategy to meet this target.*

## **Coal**

- ▶ *Set a clear timetable and deadline for phasing out – with the goal of eliminating – domestic coal production and consumption subsidies; replace subsidies with direct assistance for low-income customers and regional policy measures if necessary.*
- ▶ *Promote energy security through the availability of freely traded coal on an international market, rather than through resource ownership.*

## **Oil**

- ▶ *Continue efforts to lower oil dependence and diversify oil supply sources.*

- ▶ *Continue to closely monitor the market and, if necessary, take measures to prevent unfair practices.*
- ▶ *Work to phase out differentiated import tax rates for crude oil and petroleum products in order to increase competition by levelling the retail market playing field.*
- ▶ *Continue to ensure that oil loans to industry do not result in stocks falling below mandated IEA levels and that any transactions that result in stock level changes are reflected in data submitted to the IEA in a timely manner.*
- ▶ *Ensure that oil loans to industry are made solely to mitigate unexpected supply disruptions, and only under fair and transparent terms applying equally to all market participants.*

## **Natural Gas**

- ▶ *Build on earlier efforts to open up the gas market by establishing a timetable for comprehensive gas market reform, beginning the process as soon as possible.*
- ▶ *Establish an independent regulator to oversee the gas market as the first step in the liberalisation process.*
- ▶ *Institute open access/regulated third-party access on pipelines and ensure the regulator monitors open access implementation and has the power to penalise network operators who do not comply with the terms.*
- ▶ *Ensure that the relevant regulator monitors the activities of the incumbent gas supplier so that these activities do not result in the abuse of market power when the market is liberalised.*
- ▶ *Effectively unbundle and regulate transmission and distribution from other parts of the value chain to enable competition while ensuring fair access.*
- ▶ *Let price signals encourage customers to use gas in ways that reduce overall seasonal variations in natural gas consumption.*
- ▶ *In the absence of sufficient price signals, implement cost-effective policy measures to smooth gas demand across winter and summer.*
- ▶ *Consider revising the existing gas emergency planning procedures to take account of structural changes in the power market that may render it less effective.*

## **Electricity**

- ▶ *Re-launch electricity market reform as soon as possible and establish a timetable with milestones.*

- ▶ *Restructure and empower the Korea Electricity Commission to become an independent regulator with sufficient power to oversee the electricity market as the first step in the liberalisation process. Have the regulator establish network tariffs using methodologies in accordance with those of best-performing IEA countries.*
- ▶ *Effectively unbundle transmission and distribution from generation.*
- ▶ *Ensure that all undue barriers to effective competition in the generation sector are removed and that the Fair Trade Commission or the Korea Electricity Commission monitors competition. Pay particular attention to the role of independent power producers in the market.*
- ▶ *Ensure that the Fair Trade Commission or the Korea Electricity Commission monitors the activities of the Korea Electric Power Corporation so that its activities do not result in the abuse of market power.*
- ▶ *Improve economic production and efficiency by providing incentives in transmission and distribution network regulation. Consider pricing transmission by location to encourage generation to be built and demand to be located in areas where it relieves congestion.*
- ▶ *Ensure that the independent regulator closely monitors wholesale price formation.*
- ▶ *Consider implementing trading arrangements, including a bid-based pool or bilateral contracting, that rely on competitive pressure to determine prices that reflect costs and signal scarcity.*
- ▶ *Eliminate price distortions and cross-subsidies, and, where necessary, adjust taxation so that electricity generation reflects environmental costs. In particular, phase out industrial and agricultural price subsidies.*
- ▶ *Replace prescriptive government planning of the future supply mix with flexible policy and transparent informational scenarios and forecasts consistent with liberalisation.*

## **Nuclear Energy**

- ▶ *Ensure that citizens and other stakeholders receive balanced information and take part in an open dialogue on the benefits and risks of nuclear facilities in their communities, taking advantage of best practices in other countries.*
- ▶ *Establish a detailed roadmap for the management and final disposal of spent fuel and other high-level waste, and take steps as soon as possible to begin implementation of the option selected, taking advantage of the experience gained by the recent site selection.*

- ▶ *Continue monitoring the level of decommissioning and waste disposal funds and their management in order to ensure that adequate money will be available for those actions.*
- ▶ *Continue to ensure the independence, expertise and strength of the safety authority.*

## **Research and Development**

- ▶ *Ensure that R&D priorities and investment levels well reflect energy policy objectives.*
- ▶ *Improve links between R&D expenditures and environmental policy objectives by including environmental criteria in cost-benefit analysis.*
- ▶ *Conduct cost-benefit analysis of R&D expenditures where appropriate.*
- ▶ *biomass, ocean, geothermal and coal-bed methane.*
- ▶ *Consider increasing financial support for R&D in alternative transport fuels, such as biofuels, given the rapid rise in fossil fuel use in transport.*
- ▶ *Assess the feasibility of various advanced clean coal technologies and continue to participate in international technology development efforts.*
- ▶ *Increase research on the functioning of liberalised energy markets, possibly in co-operation with international partners.*
- ▶ *Ensure that the comprehensive R&D programme continues to support the operation and maintenance of existing and future nuclear facilities, and actively participate in international co-operation.*