Removing Energy Subsidies in Developing and Transition Economies

By Karen Schneider and Matthew Saunders*

Introduction

Subsidies on the production and consumption of energy are used widely by governments to achieve a range of policy objectives. Many of these are non-economic objectives and include the maintenance of regional employment levels and the provision of adequate supplies of energy to the poor. However, because subsidies distort price signals and fail to reflect the true economic costs of supply, they can lead to inefficient levels of production or consumption of the subsidised good. Fossil fuel consumption subsidies, for example, can result in overuse, inefficient use and wastage of energy. And because energy is an important source of pollution, including greenhouse gases, they can also contribute to environmental damage.

The objective in this paper is to present work in progress by ABARE on the implications of removing subsidies on the consumption of energy in the developing and transition economies. This set of subsidies has been chosen because of the important contribution these economies make to projected growth in world energy demand and to potential global environmental issues. The paper considers the impacts of subsidy removal on energy consumption, production and trade as well as on the level of greenhouse gas emissions. The analysis is based on preliminary simulation results from ABARE's Global Trade and Environment Model (GTEM).

Economic Impacts of Consumption Subsidies

Because consumption subsidies lower the price of energy, consumption of energy will expand beyond its level in the absence of subsidies. Unless the subsidy is designed to overcome a market failure this is likely to be harmful for economic efficiency. In an economy with limited resources, for example, the expansion in production that results from the increased demand following the use of consumption subsidies will occur at the expense of other more efficient industries. Equally, there are significant negative externalities in the form of environmental damage associated with the consumption of energy that are exacerbated by the impacts of subsidies.

Because of the importance of energy in the world economy, the removal of energy consumption subsidies is also likely to have significant general equilibrium effects that make it difficult to predict the impacts of reform. Issues of importance in this context are the interaction between the markets for coal, gas and oil products and other sectors of the economy. When energy prices rise following the removal of subsidies, for example, there will be impacts on the costs of production of other goods, especially energy intensive goods. Relative price changes will also affect the competitiveness of goods on world markets and may lead to changes in trade flows. Also of importance is the extent of support or protection in other parts of the economy that can hinder the efficient reallocation of resources following the removal of subsidies. All of these impacts can have important consequences for economic growth.

Measuring Energy Consumption Subsidies

Measuring energy consumption subsidies is complicated by the variety of policy instruments that governments can use to reduce the costs of an activity as well as by the often poor quality of available data. In these circumstances the most common method used is to adopt the 'price gap' approach (World Bank 1997, International Energy Agency 1999). This involves measuring the difference between the domestic price of coal and a reference or unsubsidised price level. The reference price represents the efficient price that would prevail in a market undistorted by subsidies and corresponds to the opportunity cost of the last unit of the good consumed. The approach is designed to capture the net effect of all the different policy instruments that affect a good's price.

For the purpose of this study, estimates of energy consumption subsidies based on the price gap methodology have been taken from the World Bank (Rajkumar 1996). These data have been chosen because they provide a reasonably comprehensive set of subsidies for the developing and transition economies. The subsidies are measured in 1995-96, corresponding closely with the base year in GTEM. More recent data from the International Energy Agency (International Energy Agency 1999) have also been consulted. These, however, cover fewer countries than the World Bank data and they are less compatible with the GTEM country aggregation. Nevertheless, in most cases both sets of data indicate similar energy subsidy magnitudes. A brief summary of the World Bank data is presented in Table 1. A more detailed data set giving estimates of fossil fuel subsidies by three classes of user—the power sector, industry and households—was provided directly to ABARE by the World Bank and is used in the modeling exercise.

Table 1
Subsidy rates on energy commodities, 1995-96

	Petroleum products	Gas	Coal	Total
Russia		33	47	20
Other FSU	5	62	33	44
Eastern Europe		36	26	20
China	1		11	7
India			12	1
Korea			5	
Thailand	4			4
Indonesia	12			9
Mexico		39		4
South Africa	6			4

Source: Rajkumar (1996); World Bank spreadsheet provided to ABARE.

Modeling Energy Subsidies

The analysis in this paper is based on applications of ABARE's Global Trade and Environment Model. GTEM is a

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multiregion, multisector, dynamic general equilibrium model of the world economy developed to address global change policy issues. It is derived from the MEGABARE model (ABARE 1996) and the GTAP model (Hertel 1997). The model code is available on ABARE's website at http// www.abareconomics.com.

GTEM is an appropriate framework for analysing complex issues such as subsidies because it takes into account the interactions between different sectors in an economy, as well as interactions between economies, and estimates the impacts of policies on key economic variables. These include the price of consumer goods and inputs into production, sectoral and regional output, trade and investment flows and, ultimately, regional income and expenditure levels. In addition, the intertemporal nature of GTEM permits the impacts of policies to be tracked over time.

GTEM also contains a sophisticated greenhouse gas emissions accounting framework. GTEM models emissions of three greenhouse gases—carbon dioxide, methane and nitrous oxides. This allows the impacts of policies such as the removal of subsidies on emissions of greenhouse gases to be tracked.

GTEM requires a reference case or a 'business as usual' simulation against which the impacts of a policy change can be measured. The reference case projects the growth in key variables in each region in the absence of any policy changes. In this paper the reference case represents the likely outlook to 2010 for world energy consumption in the absence of any policies to reduce or remove energy consumption subsidies in developing and transition economies.

The results of the policy simulation presented in this paper represent the estimated impacts on key energy variables following the removal of energy consumption subsidies in the developing and transition economies. The simulation assumes that subsidies on coal, gas and petroleum products are removed progressively over a five year period from 2001 to 2005. The impacts on variables are projected to 2010. The estimated impacts of policy changes on economic variables are defined as the percentage deviations between the equilibrium levels of those variables in the reference case and their equilibrium levels in the policy simulation.

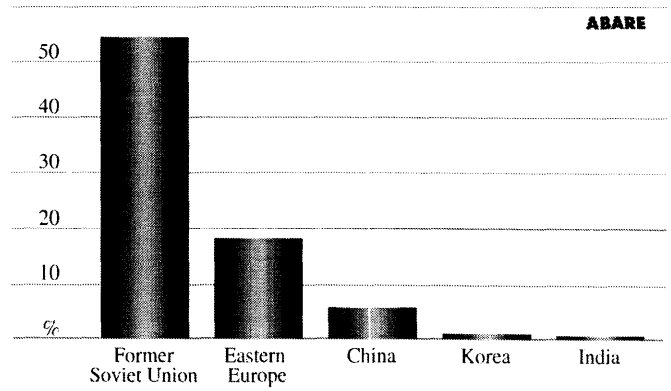
Simulation Results

When subsidies on the consumption of energy are removed there will be complex interactions within an economy, including on energy prices, consumption and trade. Because energy is a fundamental input to production processes these will be felt in the wider economy as well as by households. And because energy is widely traded, the changes that occur in energy subsidising economies will be transmitted to some extent to world markets.

Energy Price Impacts in Economies that Remove Subsidies

The simulation results show that in economies that remove subsidies, most consumer prices for energy rise relative to the reference case at 2010. The magnitude of the increase is related to the size of the subsidy. In China, for example, where subsidies on coal are moderate, average consumer coal prices are 6 percent higher at 2010 when subsidies are removed than

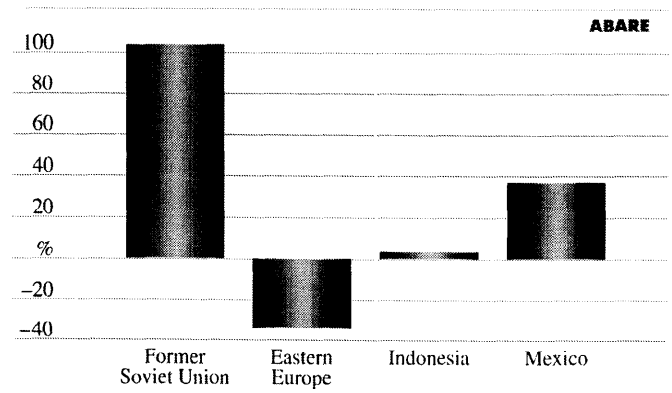
Figure 1
Change in coal prices following removal of subsidies, 2010, relative to the reference case



in the reference case (Figure 1). Coal subsidies in the former Soviet Union and eastern Europe are larger than elsewhere and, as a result, consumer price rises in these markets relative to the reference case are more significant.

A similar situation is apparent in gas markets (Figure 2). The major subsidisers of gas are the former Soviet Union and Eastern Europe, where the largest subsidies are provided to the household sector. When these are removed consumer gas prices by 2010 rise predictably in the former Soviet Union relative to the reference case but actually fall relative to the reference case in Eastern Europe. This is because the former Soviet Union diverts production from domestic to export markets as domestic consumption contracts and Eastern

Figure 2
Change in gas prices following removal of subsidies, 2010, relative to the reference case



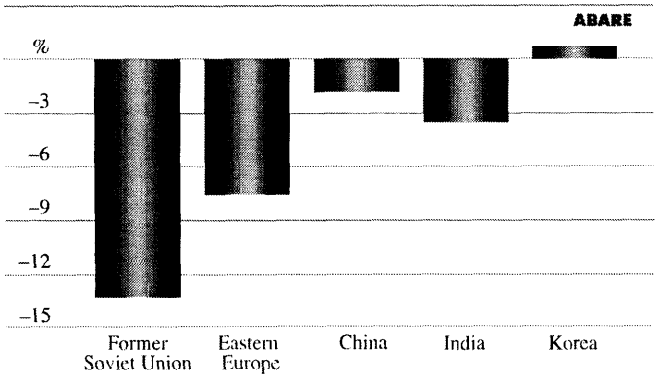
European economies are able to purchase lower priced imported gas. Mexico also provides large subsidies to gas users in all sectors and consumer gas prices rise strongly relative to the reference case after subsidy removal.

Energy Consumption Impacts

As a result of energy price rises following the removal of subsidies, energy consumption falls in most of the subsidising countries at 2010 relative to the reference case. In the former

Soviet Union, for example, coal consumption at 2010 is 13 percent below the reference case following the removal of large subsidies and the consequent significant increase in consumer coal prices (Figure 3). In Eastern Europe where

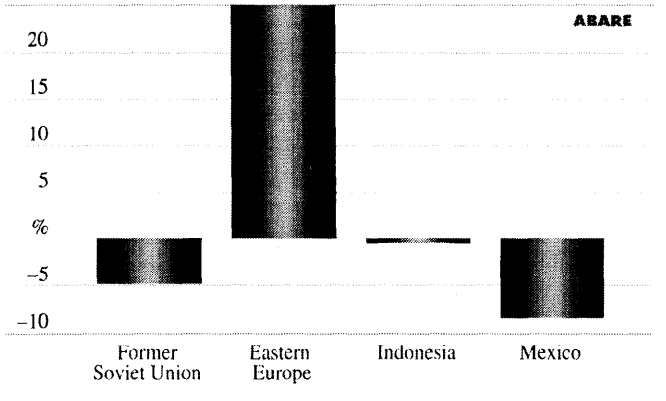
Figure 3
Change in coal consumption following removal of subsidies, 2010, relative to the reference case



coal subsidies are also high, total coal consumption at 2010 is 8 per cent below reference case levels.

In the case of gas, consumption falls relative to the reference case in all the subsidising economies following the rises in consumer prices, with the exception of Eastern Europe (Figure 4). This occurs because, as discussed above, when consumption of gas in the former Soviet Union declines, domestic production is diverted to export markets, principally Eastern Europe. The consumer price of gas is lower in the

Figure 4
Change in gas consumption following removal of subsidies, 2010, relative to the reference case



eastern European economies at 2010 than in the reference case and their demand for gas rises.

The removal of differential subsidies on a range of fuels in any one economy can also lead to strong interfuel substitution. This is especially the case in sectors such as electricity where interfuel substitution possibilities are much greater than, for example, in transport. In China, the removal of subsidies leads to some increase in the share of oil fired power generation at 2010 relative to the reference case because the subsidy on petroleum products is much lower than that on coal.

One of the major factors driving the changes in energy consumption that result from the removal of subsidies is the shift in patterns of energy intensive production. There are significant declines in energy intensive output at 2010 relative to the reference case in some economies because the increasing price of energy inputs to production increases the cost structure in these industries and reduces their competitiveness. In the case of the iron and steel industry, for example, production falls in China, Indonesia, India and South Africa relative to the reference case.

Trade and World Price Impacts

Given the changes in prices and consumption that result from subsidy removal there are consequential impacts on the domestic production of energy and on energy exports. In most cases where economies that subsidise energy consumption are also large producers of energy, there is a shift in production from domestic to export markets. This occurs because the price that producers receive from domestic consumers falls relative to the prices they can receive on export markets. On average, exports of coal from economies that remove subsidies are 20 percent higher at 2010 than their level in the reference case and exports of petroleum products are 3 percent higher. In the case of gas, exports rise significantly above reference case levels because of the impacts of gas exports from the former Soviet Union.

Increased exports of energy relative to the reference case from the economies where subsidies have been removed exert downward pressure on world energy prices. For example, the world price of coal at 2010 is 4 percent below its level in the reference case and the average world price of petroleum products is 2 percent lower. Because by far the greatest increases in exports occur in gas markets, the world price for gas falls further than for other fuels relative to the reference case.

The downward impacts on world energy prices lead to increases in energy consumption relative to the reference case in the developed economies and in other economies that do not subsidise energy consumption. For example, coal consumption in the developed economies at 2010 is 0.15 percent higher than in the reference case and petroleum products consumption rises by 0.6 percent. Gas consumption rises more strongly by 2010 relative to the reference case because of the large impacts on the world price of this fuel.

Increases in developed country energy consumption following the removal of subsidies do not completely offset the declines in the developing and transition economies. As a result, world fossil fuel consumption at 2010 is below reference case levels (Figure 5).

Impacts on Greenhouse Gas Emissions

Because the combustion of fossil fuels is the most important contributor to greenhouse gas emissions, any changes in energy consumption that arise from the removal of energy subsidies will have important consequences for world emissions. Following the decline in energy consumption in the developing economies after energy subsidies are removed, emissions in this region fall by around 1 per cent at 2010 relative to the reference case (Figure 6). Emission reductions

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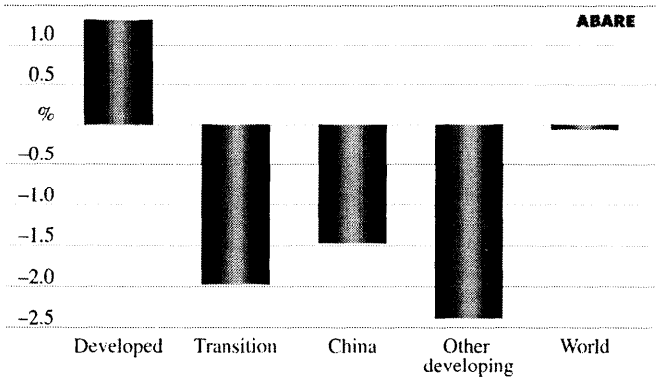
are much larger in the transition economies because energy

Figure 5
Change in consumption of fossil fuels following removal of subsidies, 2010, relative to the reference case



consumption falls are greater. However, in the developed economies where energy consumption rises relative to the reference case, greenhouse gas emissions at 2010 are also higher than reference case levels. The net effect at the world level is that greenhouse gas emissions at 2010 are 1.1 percent lower than they would be if subsidies remained in place.

These estimates of emission reductions are based on the simulation results only and exclude any consideration of possible greenhouse gas emission response policies in economies that are Annex B parties to the Kyoto Protocol. If Annex B parties to the protocol implemented emission reduction policies simultaneously with the removal of subsidies in other economies, the impacts on emissions could be different from those outlined above.

It should be noted that the impact on world emissions reported in this paper are considerably smaller than other research has found. The International Energy Agency, for example, estimates that following the removal of subsidies in eight large developing countries, world emissions of greenhouse gases could fall by 4.6 percent (International Energy Agency 1999). However, the nature of the analysis in the two studies is quite different with the International Energy Agency adopting a partial, single country approach to analysing energy consumption and greenhouse gas emission impacts. That is, no account is taken in that study of the potential for interfuel substitution in an economy that could reduce the impacts of subsidy removal on energy consumption and emissions. The analysis is also likely to overstate the potential reduction in emissions because it does not consider the impact of lower demand in economies that subsidise fossil fuels on world fossil fuel prices. As analysis in this paper shows, this could have a marked impact on energy consumption and greenhouse gas emissions in these economies.

Economic Impacts

Because the removal of subsidies has impacts on prices, the structure of production and trade flows, there will be consequences for economic efficiency and growth. These will extend not only to economies that subsidise energy but to others that are affected by the removal of subsidies through price and trade linkages. There will be additional benefits to economies that subsidise energy where subsidies are provided as direct transfers from government. In this case the removal of subsidies will reduce the fiscal burden and may lead to increased opportunities for growth-creating investment.

The simulation results indicate that both economies that subsidise energy consumption and other economies benefit when subsidies are removed. In the economies that remove subsidies, GDP at 2010 is almost half of a percent higher than in the reference case. In the developed economies where access to cheaper energy provides a competitive advantage, GDP rises by 0.1 percent relative to the reference case.

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