# Appendix A. Estimating Pretax and Posttax Global Energy Subsidies

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This appendix describes the data sources and methodologies used for the estimation of subsidies for petroleum products, coal, natural gas, and electricity.

## PRETAX SUBSIDIES

### Petroleum Products

Pretax consumer subsidies for gasoline, diesel, and kerosene are estimated as the difference between international prices, adjusted upward for transportation and distribution margins, and domestic consumer prices, for 176 countries between 2000 and 2011.[1] It should be noted that all these subsidy estimates are based on comparisons for prices of final products (e.g., gasoline) rather than unrefined products (such as crude oil).

For countries for which the Organisation for Economic Co-operation and Development (OECD) has detailed data on pretax prices and petroleum product taxes, pretax prices are used to measure supply costs. For other countries, supply costs are based on spot prices from the International Energy Agency (IEA). For net oil-importers among these countries, margins are assumed to be US$0.10 per liter to cover international transport costs and another US$0.10 per liter to cover domestic distribution and retailing costs. For net oil exporters, no adjustment is made, because the international transport cost is saved when the product is consumed domestically rather than exported. This is assumed to offset domestic distribution and retailing costs.

Domestic consumer prices for petroleum products (for both firms and households) are taken from publicly available sources for OECD countries. For other countries, domestic prices were provided by country authorities to IMF staff and supplemented by survey data from the Deutsche Gesellschaft für Internationale Zusammenarbeit (Ebert and others, 2009). For gasoline, the price is for regular unleaded or other grades, based on availability. Where consumer prices were

[1]Subsidies for oil-based heating fuels and fuels for non-road transportation vehicles, which are substantial in some countries, are not included because of data limitations.



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unavailable, they were imputed based on observed pass-through behavior for that country. This was done for approximately 54 countries in 2009 and one country (Venezuela) in 2011. End-of-year prices are used to estimate subsidies except for 30 countries, mostly in the Middle East and North African (MENA) region, where quarterly price data are available. Producer subsidies for petroleum products are based on OECD producer support estimates (OECD, 2012a). These estimates capture both direct budgetary transfers and preferential treatment through the tax code to petroleum producers.

The fuel-product consumption levels used to calculate total subsidies are based on OECD and IEA data and include consumption by both households and enterprises.

## Coal and Natural Gas

Consumer subsidy estimates are based on IEA data for coal in 39 countries and for natural gas in 37 countries between 2007 and 2011. IMF staff estimates on natural gas subsidies are available for an additional four countries in the MENA region. This calculation measures subsidies as the difference between the reference price and the domestic price paid by households and firms. The IEA reference prices for natural gas and coal, both traded goods, are defined differently for net importers and net exporters.[2] In addition, producer coal subsidies for 16 countries between 2007 and 2011 are based on OECD data.

For net importers, the reference price was defined as the price at the nearest international market, adjusted for quality differences, the cost of freight and insurance, distribution and marketing costs, and any value added tax (VAT). The price does not include excise duties. For net exporters, the reference price was calculated as the price at the nearest international market, adjusted for quality differences, less the costs of freight and insurance, plus distribution, marketing, and VAT. It should be noted that the quantities of coal and natural gas used in this calculation do not include the amount used for electricity and heat generation. To estimate pretax subsidies, the VAT is subtracted from the IEA estimates, using the standard VAT rate in the country. Producer subsidies for coal are based on OECD producer support estimates that capture the amount of tax subsidies (such as special income tax treatment) or budgetary expenditures designed to support producer incomes (OECD, 2012a).

## Electricity

Given the varying availability of data, a number of different approaches are taken to measure subsidies. For 40 countries in sub-Saharan Africa, the Middle East and North Africa, and a few selected emerging economies in Europe, estimates of combined producer and consumer subsidies are compiled from various

[2]Although coal and natural gas are traded in international markets, transportation costs for these products are high, and a large share of both is consumed domestically or in the regions where they are produced.

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World Bank reports and IMF staff estimates; thus, they are not necessarily comparable. For these countries, subsidy estimates are based on average domestic prices and cost-recovery prices that cover production costs, investment cost, distributional loss, and the nonpayment of electricity bills. An upward adjustment is also made for the input subsidies that electricity producers may receive through their use of subsidized fossil fuel products. For 31 of these 40 countries, the latest year for which data are available is 2009.

For 37 countries, estimates of consumer price subsidies between 2007 and 2011 are taken from the IEA, based on the difference between costs (adjusted for any subsidy on fossil fuel inputs) and average domestic prices (IEA, 2011b). As these prices do not include investment cost, nonpayment of electricity, or distributional losses, the estimates may understate the subsidies. In total, the sample covers 77 countries.

## POSTTAX SUBSIDIES

Posttax subsidies are estimated as pretax subsidies plus

- *a corrective (or "Pigouvian") tax*, reflecting an (excise) tax on energy products to charge for externalities associated with $CO_2$ emissions, local pollution, and (in the case of gasoline and motor diesel) other externalities such as traffic congestion and accidents; and
- *a revenue component*, reflecting an (ad valorem) tax on energy products consumed by households that would be consistent with taxation of any other consumer good at the standard VAT or general sales tax (GST) rate.

### Corrective Taxes

This section discusses the estimation of taxes needed to correct for externalities from petroleum products, coal, and natural gas. To avoid double counting we do not measure externalities from electricity generation, and because of the lack of available evidence, we do not measure externalities for other generation fuels.[3] Owing to the lack of systematic cross-country data, the subsidy estimates do not take into account certain charges and taxes for energy that are often rationalized on environmental grounds.[4] Environmental and transportation-related

[3]For example, for nuclear power it is extremely difficult to quantify the risks from radioactive waste and meltdowns.

[4]Principally, these include regional or country-level carbon pricing programs, road user charges (e.g., mileage-based tolls for trucks in Germany) and excise taxes on electricity consumption and vehicle sales. For example, the European Union Emissions Trading System imposes a carbon tax on certain greenhouse gases that are emitted by factories, power plants, and other installations in the system. The current prevailing prices, however, are only a small fraction of estimated damages, and only about half of emissions are covered under the scheme. To take another example, incorporating the road user charges for diesel vehicles in New Zealand would lower our posttax energy subsidy estimates for that country by US$0.8 billion.

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externalities have been quantified for the United States and just a few other countries.[5]

### *Petroleum Products*

Combustion of petroleum products (gasoline, diesel, and kerosene) generates both carbon dioxide ($CO_2$) emissions, which contribute to future global warming, and local air pollution, which elevates mortality risks for people inhaling the pollution. Other externalities associated with motor vehicle use—which we apportion to gasoline and diesel fuels—include traffic congestion and accidents and (primarily in the case of trucks) road damage. Table A.1 summarizes some estimates of motor fuel taxes to correct for these externalities that have been conducted for the United States, the United Kingdom, and Chile. The corrective tax estimate is highest for Chile, where there is a high incidence of traffic fatalities (especially for pedestrians), a large portion of nationwide driving occurs under highly congested conditions, and vehicles have relatively high emission rates.

For $CO_2$ emissions, we assume an illustrative value for global warming damages of US$34 per ton (in 2007 dollars), following the United States Interagency Working Group on Social Cost of Carbon (2013). The estimates in the literature have varied considerably, however—for example, Nordhaus (2011) estimates damages of US$12 per ton, and Stern (2006) estimates US$85 per ton. The US$34 per ton of $CO_2$ emissions is applied to all fuels and, for example, translates into US$0.07–US$0.09 per liter of gasoline or diesel (Table A.1).

A careful assessment of the noncarbon corrective fuel taxes for other countries would take into account a variety of local factors affecting the willingness to pay for reductions in these negative externalities, including, most important, income, local emission rates, population density, travel delays, and the frequency of traffic acci-

**TABLE A.1**

Corrective Motor Fuel Taxes, Selected Countries
*(Cents per liter, 2011 dollars)*

| | Gasoline (cars) | | | Diesel (trucks) | |
|---|---|---|---|---|---|
| | United States | United Kingdom | Chile | United States | Chile |
| Total | 38 | 44 | 73 | 40 | 65 |
| Contribution of: | | | | | |
| local pollution | 3 | 4 | 18 | 10 | 16 |
| carbon | 8 | 7 | 8 | 9 | 9 |
| congestion | 15 | 26 | 19 | 10 | 16 |
| accidents | 12 | 8 | 28 | 3 | 12 |
| noise | 0 | 0 | 0 | 2 | 1 |
| road damage | 0 | 0 | 0 | 6 | 12 |

Sources: Institute for Fiscal Studies (2012); Parry (2011); Parry and Small (2005); Parry and Strand (2011).
Note: The above studies estimate corrective diesel fuel taxes for the United States and Chile but not for the United Kingdom.

[5]More detailed work for other countries is under way in the Fiscal Affairs Department to provide more precise estimates (IMF, forthcoming).

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dents. Internationally comprehensive data on these factors are not readily available, except for income per capita. We make adjustments to the estimates of willingness to pay by comparing a given country's income (e.g., Colombia) in purchasing parity terms with the United States, the United Kingdom, and Chile.[6] An income elasticity of 0.8 is assumed between the willingness to pay for reductions in externalities and per capita income, following the OECD (OECD, 2012b). We then apply this correction to the estimates of externalities per liter described in Appendix Table A.1 for the United States, the United Kingdom, and Chile. We then take the average across the three countries to arrive at our estimate for Colombia.

### *Coal*

To estimate the corrective tax per ton of coal for global warming damages, we first derive $CO_2$ emissions per ton of coal, based on IEA data on coal consumption and $CO_2$ emissions from coal by country. The corrective tax per ton of coal is then calculated by multiplying $CO_2$ emissions per ton of coal consumption with the global warming damages of US$34 per ton of $CO_2$ emissions.

Beyond its $CO_2$ emissions, the other major externality associated with coal combustion is local air pollution, where the most important problem is the fine particulates (that permeate the lungs) formed from chemical reactions involving sulfur dioxide ($SO_2$) emissions. A state-of-the-art modeling exercise for the United States by a committee of experts (National Research Council, 2009) put the local pollution damages from the average coal plant in 2005 at about US$65 (in 2010 dollars) per (short) ton. This estimate is extrapolated to other countries based on per capita income, in the same way as for petroleum products. This approach does not adjust for cross-country differences in the pollution content of coal or the use of technologies to "scrub" emissions from the smokestack.

### *Natural Gas*

Natural gas is far less emissions-intensive than coal—it produces about half the carbon emissions per unit of energy and only very minimal $SO_2$ emissions. For natural gas, then, only a carbon damage is applied. As with coal, the corrective tax is calculated (based on IEA data) by emissions per thousand cubic feet times US$34 per ton of $CO_2$ emissions.

## Revenue Component

Here a scenario where energy products would be taxed just like other consumer goods is considered.[7] The estimates are based on VAT rates for 150 countries in

[6]Posttax subsidies as a share of GDP for low-income countries would increase from 3.3 percent of GDP to 5.3 percent without this adjustment for noncarbon externalities of petroleum products and coal.

[7]In principle, individual products should be taxed more heavily, or less heavily, than the average consumer good (on revenue-raising grounds), depending on whether taxing them causes a significant shift toward untaxed goods (e.g., leisure and products that are exempt from VAT). However, there is little empirical support on which to make these types of adjustments, so they are not pursued here.

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2011. For countries where VAT rates are not available or do not apply, the average VAT rate of countries with a similar level of income in the region is assumed.

## Calculating Subsidies with Corrective Tax and Revenue Components

To quantify the magnitude of subsidies, the subsidy-free posttax prices are derived by applying the VAT or GST rates to both pretax prices and excise tax for externalities. The subsidy-free posttax prices are then compared with domestic prices and combined with consumption levels to compute subsidies. In the case of electricity, VAT or GST is estimated only for countries with pretax subsidies. This approach is followed because both domestic prices and cost-recovery prices are unknown for other countries. In the case of coal and natural gas, it is assumed that domestic prices in countries without pretax subsidies are the same as international reference prices.

One complication is that revenue from VAT would be effectively assessed only on energy products as final consumption goods, not on those as intermediate inputs for other consumption goods. To separate intermediate inputs from final consumption goods, we use IEA energy consumption data by industry type. It is assumed that energy products for residential use, commercial and public services, and gasoline for road use are final consumption goods. This approximation indicates that, on average, 99 percent of gasoline consumption, 7 percent of diesel consumption, 39 percent of kerosene consumption, 12 percent of coal consumption, 46 percent of natural gas consumption, and 51 percent of electricity consumption can be categorized as final consumption.

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**TABLE A.2**

Pretax Subsidies in Percent of GDP for Petroleum Products, Electricity, Natural Gas, and Coal, 2011[1]
*(Countries sorted by income category and region)*

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Advanced** | | | | |
| Australia | 0.04 | n.a. | 0.01 | 0.00 |
| Austria | 0.03 | n.a. | n.a. | n.a. |
| Belgium | 0.58 | n.a. | n.a. | n.a. |
| Canada | 0.05 | n.a. | 0.03 | 0.00 |
| Cyprus | 0.00 | n.a. | n.a. | n.a. |
| Czech Republic | 0.00 | n.a. | n.a. | n.a. |
| Denmark | 0.00 | n.a. | n.a. | n.a. |
| Estonia | 0.00 | n.a. | n.a. | n.a. |
| Finland | 0.00 | n.a. | n.a. | n.a. |
| France | 0.01 | n.a. | 0.00 | n.a. |
| Germany | 0.01 | n.a. | 0.00 | 0.07 |
| Greece | 0.09 | n.a. | n.a. | 0.00 |
| Hong Kong SAR | 0.00 | n.a. | n.a. | n.a. |
| Iceland | 0.00 | n.a. | n.a. | n.a. |
| Ireland | 0.00 | n.a. | n.a. | 0.05 |
| Israel | 0.00 | n.a. | 0.00 | n.a. |
| Italy | 0.00 | n.a. | n.a. | n.a. |
| Japan | 0.00 | n.a. | 0.00 | n.a. |
| Korea | 0.00 | n.a. | 0.00 | 0.02 |
| Luxembourg | 0.00 | n.a. | n.a. | n.a. |
| Malta | 0.00 | n.a. | n.a. | n.a. |
| Netherlands | 0.00 | n.a. | n.a. | n.a. |
| New Zealand | 0.00 | n.a. | n.a. | n.a. |
| Norway | 0.01 | n.a. | 0.01 | 0.00 |
| Portugal | 0.00 | n.a. | n.a. | 0.00 |
| Singapore | 0.00 | n.a. | n.a. | n.a. |
| Slovak Republic | 0.00 | n.a. | n.a. | 0.01 |
| Slovenia | 0.00 | n.a. | n.a. | 0.02 |
| Spain | 0.00 | n.a. | n.a. | 0.03 |
| Sweden | 0.00 | n.a. | n.a. | n.a. |
| Switzerland | 0.00 | n.a. | n.a. | n.a. |
| Taiwan Province of China | n.a. | 0.22 | 0.00 | 0.03 |
| United Kingdom | 0.01 | n.a. | 0.01 | n.a. |
| United States | 0.07 | n.a. | 0.02 | 0.00 |
| **CEE-CIS** | | | | |
| Albania | 0.00 | n.a. | n.a. | n.a. |
| Armenia | 0.45 | 0.05 | n.a. | n.a. |
| Azerbaijan | 0.84 | 0.73 | 1.16 | 0.00 |
| Belarus | 0.00 | 0.26 | n.a. | n.a. |
| Bosnia and Herzegovina | 0.00 | n.a. | n.a. | n.a. |
| Bulgaria | 0.00 | n.a. | n.a. | n.a. |
| Croatia | 0.00 | n.a. | n.a. | n.a. |
| Georgia | 0.55 | n.a. | n.a. | n.a. |
| Hungary | 0.00 | n.a. | n.a. | 0.00 |
| Kazakhstan | 0.65 | 0.94 | 0.15 | 0.28 |
| Kosovo | 0.00 | n.a. | n.a. | n.a. |
| Kyrgyz Republic | 3.47 | 5.43 | n.a. | n.a. |
| Latvia | 0.00 | n.a. | n.a. | n.a. |
| Lithuania | 0.00 | n.a. | n.a. | n.a. |
| Macedonia, FYR | 0.00 | n.a. | n.a. | n.a. |
| Moldova | 0.00 | n.a. | n.a. | n.a. |

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**TABLE A.2 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **CEE-CIS (concluded)** | | | | |
| Mongolia | 0.00 | n.a. | n.a. | n.a. |
| Montenegro, Rep. of | 0.00 | n.a. | n.a. | n.a. |
| Poland | 0.00 | n.a. | n.a. | 0.14 |
| Romania | 0.00 | n.a. | n.a. | n.a. |
| Russia | 0.00 | 0.99 | 1.09 | 0.00 |
| Serbia | 0.00 | n.a. | n.a. | n.a. |
| Tajikistan | 0.00 | 1.95 | n.a. | n.a. |
| Turkey | 0.00 | n.a. | n.a. | 0.02 |
| Turkmenistan | 6.00 | 2.32 | 14.80 | n.a. |
| Ukraine | 0.00 | 1.61 | 3.59 | n.a. |
| Uzbekistan | 0.02 | 5.71 | 18.88 | n.a. |
| **Emerging and Developing Asia** | | | | |
| Afghanistan | 0.00 | 0.11 | n.a. | n.a. |
| Bangladesh | 0.90 | 2.63 | 1.60 | 0.00 |
| Bhutan | 0.51 | n.a. | n.a. | n.a. |
| Brunei Darussalam | 2.34 | 0.98 | 0.00 | 0.00 |
| Cambodia | 0.00 | n.a. | n.a. | n.a. |
| China | 0.00 | 0.15 | n.a. | n.a. |
| Fiji | 0.01 | n.a. | n.a. | n.a. |
| India | 1.25 | 0.32 | 0.17 | 0.00 |
| Indonesia | 2.58 | 0.66 | 0.00 | 0.00 |
| Kiribati | n.a. | n.a. | n.a. | n.a. |
| Lao P.D.R. | 0.00 | n.a. | n.a. | n.a. |
| Malaysia | 1.24 | 0.33 | 0.31 | 0.00 |
| Maldives | 0.19 | n.a. | n.a. | n.a. |
| Myanmar | 0.54 | n.a. | n.a. | n.a. |
| Nepal | 0.00 | n.a. | n.a. | n.a. |
| Pakistan | 0.13 | 1.31 | 2.54 | 0.00 |
| Papua New Guinea | n.a. | n.a. | n.a. | n.a. |
| Philippines | 0.00 | 0.00 | 0.00 | 0.00 |
| Samoa | n.a. | n.a. | n.a. | n.a. |
| Solomon Islands | 0.00 | n.a. | n.a. | n.a. |
| Sri Lanka | 1.16 | 0.47 | 0.00 | 0.00 |
| Thailand | 0.15 | 1.64 | 0.14 | 0.25 |
| Timor-Leste | 0.00 | n.a. | n.a. | n.a. |
| Tonga | 0.00 | n.a. | n.a. | n.a. |
| Tuvalu | 0.00 | n.a. | n.a. | n.a. |
| Vanuatu | 0.00 | n.a. | n.a. | n.a. |
| Vietnam | 0.00 | 2.38 | 0.13 | n.a. |
| **LAC** | | | | |
| Antigua and Barbuda | 0.49 | n.a. | n.a. | n.a. |
| Argentina | 0.00 | 1.03 | 0.77 | 0.00 |
| Bahamas, The | 0.00 | n.a. | n.a. | n.a. |
| Barbados | 0.04 | n.a. | n.a. | n.a. |
| Belize | 0.00 | n.a. | n.a. | n.a. |
| Bolivia | 2.40 | n.a. | n.a. | n.a. |
| Brazil | 0.00 | n.a. | n.a. | n.a. |
| Chile | 0.00 | 0.00 | 0.00 | 0.00 |
| Colombia | 0.00 | 0.00 | 0.00 | 0.00 |
| Costa Rica | 0.00 | n.a. | n.a. | n.a. |
| Dominica | 0.00 | n.a. | n.a. | n.a. |
| Dominican Republic | 0.00 | n.a. | n.a. | n.a. |
| Ecuador | 6.31 | 0.18 | 0.00 | 0.00 |

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**TABLE A.2 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **LAC (concluded)** | | | | |
| El Salvador | 0.00 | 0.00 | 0.00 | 0.00 |
| Grenada | 0.00 | n.a. | n.a. | n.a. |
| Guatemala | 0.00 | n.a. | n.a. | n.a. |
| Guyana | 0.00 | n.a. | n.a. | n.a. |
| Haiti | n.a. | n.a. | n.a. | n.a. |
| Honduras | 0.02 | n.a. | n.a. | n.a. |
| Jamaica | 0.00 | n.a. | n.a. | n.a. |
| Mexico | 0.00 | 0.00 | 0.00 | 0.00 |
| Nicaragua | 0.00 | n.a. | n.a. | n.a. |
| Panama | 0.02 | n.a. | n.a. | n.a. |
| Paraguay | 0.00 | n.a. | n.a. | n.a. |
| Peru | 0.00 | 0.00 | 0.00 | 0.00 |
| St. Kitts and Nevis | 0.20 | n.a. | n.a. | n.a. |
| St. Lucia | 0.19 | n.a. | n.a. | n.a. |
| St. Vincent and the Grenadines | 0.00 | n.a. | n.a. | n.a. |
| Suriname | 0.00 | n.a. | n.a. | n.a. |
| Trinidad and Tobago | 2.75 | n.a. | n.a. | n.a. |
| Uruguay | 0.00 | n.a. | n.a. | n.a. |
| Venezuela | 5.58 | 1.02 | 0.59 | n.a. |
| **MENA** | | | | |
| Algeria | 4.30 | 1.08 | 5.36 | 0.00 |
| Bahrain | 5.37 | 2.57 | n.a. | n.a. |
| Djibouti | 0.00 | 0.45 | n.a. | n.a. |
| Egypt | 6.74 | 2.30 | 1.60 | 0.00 |
| Iran | 4.20 | 3.61 | 4.83 | 0.00 |
| Iraq | 9.92 | 1.39 | 0.25 | 0.00 |
| Jordan | 2.15 | 3.81 | n.a. | n.a. |
| Kuwait | 3.09 | 2.91 | 1.29 | 0.00 |
| Lebanon | 0.07 | 4.46 | n.a. | n.a. |
| Libya | 6.40 | 1.85 | 0.59 | 0.00 |
| Mauritania | 0.00 | 0.85 | 0.80 | n.a. |
| Morocco | 0.66 | n.a. | n.a. | n.a. |
| Oman | 3.01 | 0.76 | 2.20 | n.a. |
| Qatar | 1.22 | 1.20 | 1.07 | 0.00 |
| Saudi Arabia | 7.46 | 2.48 | n.a. | 0.00 |
| Sudan | 1.37 | n.a. | n.a. | n.a. |
| Syria | n.a. | n.a. | n.a. | n.a. |
| Tunisia | 0.77 | 2.23 | n.a. | n.a. |
| United Arab Emirates | 0.48 | 1.86 | 3.37 | n.a. |
| Yemen | 4.67 | 1.33 | n.a. | n.a. |
| **Sub-Saharan Africa** | | | | |
| Angola | 1.30 | 0.27 | 0.00 | 0.00 |
| Benin | 0.00 | 1.78 | n.a. | n.a. |
| Botswana | 0.02 | 0.36 | n.a. | n.a. |
| Burkina Faso | 0.00 | 0.78 | n.a. | n.a. |
| Burundi | 0.00 | n.a. | n.a. | n.a. |
| Cameroon | 1.69 | 2.16 | n.a. | n.a. |
| Cape Verde | 0.00 | 2.17 | n.a. | n.a. |
| Central African Republic | 0.00 | n.a. | n.a. | n.a. |
| Chad | 0.00 | 0.00 | n.a. | n.a. |
| Comoros | n.a. | n.a. | n.a. | n.a. |
| Congo, Democratic Republic of the | 0.00 | 1.57 | n.a. | n.a. |

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**TABLE A.2 (CONCLUDED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Sub-Saharan Africa (concluded)** | | | | |
| Congo, Republic of | 1.20 | 2.62 | n.a. | n.a. |
| Côte d'Ivoire | 0.00 | 2.72 | n.a. | n.a. |
| Equatorial Guinea | 0.28 | n.a. | n.a. | n.a. |
| Eritrea | n.a. | n.a. | n.a. | n.a. |
| Ethiopia | 0.19 | 1.24 | n.a. | n.a. |
| Gabon | 0.16 | n.a. | n.a. | n.a. |
| Gambia, The | 0.00 | n.a. | n.a. | n.a. |
| Ghana | 0.00 | 2.86 | n.a. | n.a. |
| Guinea | 0.00 | n.a. | n.a. | n.a. |
| Guinea-Bissau | 0.00 | n.a. | n.a. | n.a. |
| Kenya | 0.00 | 0.00 | n.a. | n.a. |
| Lesotho | 0.00 | 0.85 | n.a. | n.a. |
| Liberia | 0.00 | n.a. | n.a. | n.a. |
| Madagascar | 0.11 | 0.89 | n.a. | n.a. |
| Malawi | 0.00 | 1.60 | n.a. | n.a. |
| Mali | 0.00 | 0.93 | n.a. | n.a. |
| Mauritius | 0.00 | n.a. | n.a. | n.a. |
| Mozambique | 0.00 | 4.93 | n.a. | n.a. |
| Namibia | 0.00 | 0.52 | n.a. | n.a. |
| Niger | 0.00 | 0.00 | n.a. | n.a. |
| Nigeria | 1.42 | 1.31 | 0.00 | 0.00 |
| Rwanda | 0.00 | 0.29 | n.a. | n.a. |
| Senegal | 0.00 | 2.26 | n.a. | n.a. |
| Seychelles | 0.00 | n.a. | n.a. | n.a. |
| Sierra Leone | 0.00 | n.a. | n.a. | n.a. |
| South Africa | 0.01 | 0.55 | 0.00 | 0.00 |
| Swaziland | 0.00 | n.a. | n.a. | n.a. |
| São Tomé and Príncipe | 0.33 | n.a. | n.a. | n.a. |
| Tanzania | 0.00 | 2.10 | n.a. | n.a. |
| Togo | 0.00 | n.a. | n.a. | n.a. |
| Uganda | 0.00 | 1.32 | n.a. | n.a. |
| Zambia | 0.00 | 4.85 | n.a. | n.a. |
| Zimbabwe | n.a. | 14.52 | n.a. | n.a. |
| **World** | **0.32** | **0.22** | **0.17** | **0.01** |

Sources: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); International Energy Agency (IEA), *World Energy Outlook 2012;* IMF staff estimates; IMF, *World Economic Outlook;* Organisation for Economic Co-operation and Development (OECD); World Bank.

Note: Values are rounded to the nearest one-hundredth percent; electricity subsidies are taken from 2009 for 31 countries, and natural gas data are taken from 2010 for four countries. World estimates are calculated as identified subsidies divided by global GDP. n.a. = not applicable; CEE-CIS = Central and Eastern Europe and Commonwealth of Independent States; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa.

[1]These subsidy estimates may differ from those in the country budget documents because of the methodologies described in this appendix.

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**TABLE A.3**

Pretax Subsidies in Percent of Government Revenues for Petroleum Products, Electricity, Natural Gas, and Coal, 2011[1]
*(Countries sorted by income category and region)*

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Advanced** | | | | |
| Australia | 0.13 | n.a. | 0.02 | 0.01 |
| Austria | 0.07 | n.a. | n.a. | n.a. |
| Belgium | 1.18 | n.a. | n.a. | n.a. |
| Canada | 0.13 | n.a. | 0.07 | 0.00 |
| Cyprus | 0.00 | n.a. | n.a. | n.a. |
| Czech Republic | 0.00 | n.a. | n.a. | n.a. |
| Denmark | 0.00 | n.a. | n.a. | n.a. |
| Estonia | 0.00 | n.a. | n.a. | n.a. |
| Finland | 0.00 | n.a. | n.a. | n.a. |
| France | 0.01 | n.a. | 0.00 | n.a. |
| Germany | 0.03 | n.a. | 0.00 | 0.17 |
| Greece | 0.23 | n.a. | n.a. | 0.01 |
| Hong Kong SAR | 0.00 | n.a. | n.a. | n.a. |
| Iceland | 0.00 | n.a. | n.a. | n.a. |
| Ireland | 0.00 | n.a. | n.a. | 0.14 |
| Israel | 0.00 | n.a. | 0.01 | n.a. |
| Italy | 0.00 | n.a. | n.a. | n.a. |
| Japan | 0.01 | n.a. | 0.00 | n.a. |
| Korea | 0.00 | n.a. | 0.00 | 0.06 |
| Luxembourg | 0.00 | n.a. | n.a. | n.a. |
| Malta | 0.00 | n.a. | n.a. | n.a. |
| Netherlands | 0.00 | n.a. | n.a. | n.a. |
| New Zealand | 0.00 | n.a. | n.a. | n.a. |
| Norway | 0.02 | n.a. | 0.02 | 0.00 |
| Portugal | 0.00 | n.a. | n.a. | 0.01 |
| Singapore | 0.00 | n.a. | n.a. | n.a. |
| Slovak Republic | 0.00 | n.a. | n.a. | 0.02 |
| Slovenia | 0.00 | n.a. | n.a. | 0.05 |
| Spain | 0.00 | n.a. | n.a. | 0.08 |
| Sweden | 0.00 | n.a. | n.a. | n.a. |
| Switzerland | 0.00 | n.a. | n.a. | n.a. |
| Taiwan Province of China | n.a. | 1.16 | 0.00 | 0.17 |
| United Kingdom | 0.03 | n.a. | 0.02 | n.a. |
| United States | 0.22 | n.a. | 0.06 | 0.01 |
| **CEE-CIS** | | | | |
| Albania | 0.00 | n.a. | n.a. | n.a. |
| Armenia | 2.06 | 0.22 | n.a. | n.a. |
| Azerbaijan | 1.85 | 1.59 | 2.54 | 0.00 |
| Belarus | 0.00 | 0.62 | n.a. | n.a. |
| Bosnia and Herzegovina | 0.00 | n.a. | n.a. | n.a. |
| Bulgaria | 0.00 | n.a. | n.a. | n.a. |
| Croatia | 0.00 | n.a. | n.a. | n.a. |
| Georgia | 1.95 | n.a. | n.a. | n.a. |
| Hungary | 0.00 | n.a. | n.a. | 0.00 |
| Kazakhstan | 2.33 | 3.38 | 0.55 | 1.01 |
| Kosovo | 0.00 | n.a. | n.a. | n.a. |
| Kyrgyz Republic | 10.41 | 16.30 | n.a. | n.a. |
| Latvia | 0.00 | n.a. | n.a. | n.a. |
| Lithuania | 0.00 | n.a. | n.a. | n.a. |
| Macedonia, FYR | 0.00 | n.a. | n.a. | n.a. |
| Moldova | 0.00 | n.a. | n.a. | n.a. |

(Continued)

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**TABLE A.3 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **CEE-CIS (concluded)** | | | | |
| Mongolia | 0.00 | n.a. | n.a. | n.a. |
| Montenegro, Rep. of | 0.00 | n.a. | n.a. | n.a. |
| Poland | 0.00 | n.a. | n.a. | 0.36 |
| Romania | 0.00 | n.a. | n.a. | n.a. |
| Russia | 0.00 | 2.58 | 2.85 | 0.00 |
| Serbia | 0.00 | n.a. | n.a. | n.a. |
| Tajikistan | 0.00 | 7.85 | n.a. | n.a. |
| Turkey | 0.00 | n.a. | n.a. | 0.07 |
| Turkmenistan | 31.84 | 12.29 | 78.48 | n.a. |
| Ukraine | 0.00 | 3.80 | 8.47 | n.a. |
| Uzbekistan | 0.06 | 14.20 | 46.94 | n.a. |
| **Emerging and Developing Asia** | | | | |
| Afghanistan | 0.00 | 0.52 | n.a. | n.a. |
| Bangladesh | 7.56 | 22.12 | 13.45 | 0.00 |
| Bhutan | 1.39 | n.a. | n.a. | n.a. |
| Brunei Darussalam | 3.77 | 1.57 | 0.00 | 0.00 |
| Cambodia | 0.00 | n.a. | n.a. | n.a. |
| China | 0.00 | 0.68 | n.a. | n.a. |
| Fiji | 0.05 | n.a. | n.a. | n.a. |
| India | 6.75 | 1.72 | 0.90 | 0.00 |
| Indonesia | 14.51 | 3.69 | 0.00 | 0.00 |
| Kiribati | n.a. | n.a. | n.a. | n.a. |
| Lao P.D.R. | 0.00 | n.a. | n.a. | n.a. |
| Malaysia | 5.67 | 1.49 | 1.41 | 0.00 |
| Maldives | 0.61 | n.a. | n.a. | n.a. |
| Myanmar | 9.35 | n.a. | n.a. | n.a. |
| Nepal | 0.00 | n.a. | n.a. | n.a. |
| Pakistan | 1.02 | 10.23 | 19.89 | 0.00 |
| Papua New Guinea | n.a. | n.a. | n.a. | n.a. |
| Philippines | 0.00 | 0.00 | 0.00 | 0.00 |
| Samoa | n.a. | n.a. | n.a. | n.a. |
| Solomon Islands | 0.00 | n.a. | n.a. | n.a. |
| Sri Lanka | 7.99 | 3.26 | 0.00 | 0.00 |
| Thailand | 0.66 | 7.24 | 0.61 | 1.08 |
| Timor-Leste | 0.00 | n.a. | n.a. | n.a. |
| Tonga | 0.00 | n.a. | n.a. | n.a. |
| Tuvalu | 0.00 | n.a. | n.a. | n.a. |
| Vanuatu | 0.00 | n.a. | n.a. | n.a. |
| Vietnam | 0.00 | 8.59 | 0.47 | n.a. |
| **LAC** | | | | |
| Antigua and Barbuda | 2.36 | n.a. | n.a. | n.a. |
| Argentina | 0.00 | 2.76 | 2.06 | 0.00 |
| Bahamas, The | 0.00 | n.a. | n.a. | n.a. |
| Barbados | 0.10 | n.a. | n.a. | n.a. |
| Belize | 0.00 | n.a. | n.a. | n.a. |
| Bolivia | 6.62 | n.a. | n.a. | n.a. |
| Brazil | 0.00 | n.a. | n.a. | n.a. |
| Chile | 0.00 | 0.00 | 0.00 | 0.00 |
| Colombia | 0.00 | 0.00 | 0.00 | 0.00 |
| Costa Rica | 0.00 | n.a. | n.a. | n.a. |
| Dominica | 0.00 | n.a. | n.a. | n.a. |
| Dominican Republic | 0.00 | n.a. | n.a. | n.a. |
| Ecuador | 15.44 | 0.44 | 0.00 | 0.00 |

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**TABLE A.3 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **LAC (concluded)** | | | | |
| El Salvador | 0.00 | 0.00 | 0.00 | 0.00 |
| Grenada | 0.00 | n.a. | n.a. | n.a. |
| Guatemala | 0.00 | n.a. | n.a. | n.a. |
| Guyana | 0.00 | n.a. | n.a. | n.a. |
| Haiti | n.a. | n.a. | n.a. | n.a. |
| Honduras | 0.09 | n.a. | n.a. | n.a. |
| Jamaica | 0.00 | n.a. | n.a. | n.a. |
| Mexico | 0.00 | 0.00 | 0.00 | 0.00 |
| Nicaragua | 0.00 | n.a. | n.a. | n.a. |
| Panama | 0.08 | n.a. | n.a. | n.a. |
| Paraguay | 0.00 | n.a. | n.a. | n.a. |
| Peru | 0.00 | 0.00 | 0.00 | 0.00 |
| St. Kitts and Nevis | 0.55 | n.a. | n.a. | n.a. |
| St. Lucia | 0.68 | n.a. | n.a. | n.a. |
| St. Vincent and the Grenadines | 0.00 | n.a. | n.a. | n.a. |
| Suriname | 0.00 | n.a. | n.a. | n.a. |
| Trinidad and Tobago | 7.49 | n.a. | n.a. | n.a. |
| Uruguay | 0.00 | n.a. | n.a. | n.a. |
| Venezuela | 15.83 | 2.89 | 1.66 | n.a. |
| **MENA** | | | | |
| Algeria | 10.84 | 2.72 | 13.52 | 0.00 |
| Bahrain | 18.96 | 9.08 | n.a. | n.a. |
| Djibouti | 0.00 | 1.32 | n.a. | n.a. |
| Egypt | 30.61 | 10.44 | 7.25 | 0.00 |
| Iran | 16.95 | 14.54 | 19.45 | 0.00 |
| Iraq | 12.69 | 1.78 | 0.32 | 0.00 |
| Jordan | 8.13 | 14.41 | n.a. | n.a. |
| Kuwait | 4.57 | 4.30 | 1.91 | 0.00 |
| Lebanon | 0.32 | 18.96 | n.a. | n.a. |
| Libya | 16.64 | 4.80 | 1.53 | 0.00 |
| Mauritania | 0.00 | 3.09 | 2.91 | n.a. |
| Morocco | 2.40 | n.a. | n.a. | n.a. |
| Oman | 7.28 | 1.83 | 5.31 | n.a. |
| Qatar | 3.17 | 3.12 | 2.78 | 0.00 |
| Saudi Arabia | 14.00 | 4.66 | 0.00 | 0.00 |
| Sudan | 7.33 | n.a. | n.a. | n.a. |
| Syria | n.a. | n.a. | n.a. | n.a. |
| Tunisia | 2.42 | 7.02 | n.a. | n.a. |
| United Arab Emirates | 1.38 | 5.32 | 9.61 | n.a. |
| Yemen | 19.03 | 5.42 | n.a. | n.a. |
| **Sub-Saharan Africa** | | | | |
| Angola | 2.67 | 0.55 | 0.00 | 0.00 |
| Benin | 0.00 | 8.84 | n.a. | n.a. |
| Botswana | 0.07 | 1.21 | n.a. | n.a. |
| Burkina Faso | 0.00 | 3.59 | n.a. | n.a. |
| Burundi | 0.00 | n.a. | n.a. | n.a. |
| Cameroon | 8.92 | 11.42 | n.a. | n.a. |
| Cape Verde | 0.00 | 8.66 | n.a. | n.a. |
| Central African Republic | 0.00 | n.a. | n.a. | n.a. |
| Chad | 0.00 | 0.00 | n.a. | n.a. |
| Comoros | n.a. | n.a. | n.a. | n.a. |
| Congo, Democratic Republic of the | 0.00 | 5.75 | n.a. | n.a. |
| Congo, Republic of | 2.82 | 6.17 | n.a. | n.a. |

(Continued)

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**TABLE A.3 (CONCLUDED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Sub-Saharan Africa (concluded)** | | | | |
| Côte d'Ivoire | 0.00 | 13.43 | n.a. | n.a. |
| Equatorial Guinea | 0.92 | n.a. | n.a. | n.a. |
| Eritrea | n.a. | n.a. | n.a. | n.a. |
| Ethiopia | 1.12 | 7.40 | n.a. | n.a. |
| Gabon | 0.56 | n.a. | n.a. | n.a. |
| Gambia, The | 0.00 | n.a. | n.a. | n.a. |
| Ghana | 0.00 | 14.70 | n.a. | n.a. |
| Guinea | 0.00 | n.a. | n.a. | n.a. |
| Guinea-Bissau | 0.00 | n.a. | n.a. | n.a. |
| Kenya | 0.00 | 0.00 | n.a. | n.a. |
| Lesotho | 0.00 | 1.61 | n.a. | n.a. |
| Liberia | 0.00 | n.a. | n.a. | n.a. |
| Madagascar | 0.95 | 7.86 | n.a. | n.a. |
| Malawi | 0.00 | 5.43 | n.a. | n.a. |
| Mali | 0.00 | 3.98 | n.a. | n.a. |
| Mauritius | 0.00 | n.a. | n.a. | n.a. |
| Mozambique | 0.00 | 16.40 | n.a. | n.a. |
| Namibia | 0.00 | 1.82 | n.a. | n.a. |
| Niger | 0.00 | 0.00 | n.a. | n.a. |
| Nigeria | 4.82 | 4.44 | 0.00 | 0.00 |
| Rwanda | 0.00 | 1.14 | n.a. | n.a. |
| Senegal | 0.00 | 10.08 | n.a. | n.a. |
| Seychelles | 0.00 | n.a. | n.a. | n.a. |
| Sierra Leone | 0.00 | n.a. | n.a. | n.a. |
| South Africa | 0.02 | 2.01 | 0.00 | 0.00 |
| Swaziland | 0.00 | n.a. | n.a. | n.a. |
| São Tomé and Príncipe | 0.90 | n.a. | n.a. | n.a. |
| Tanzania | 0.00 | 9.50 | n.a. | n.a. |
| Togo | 0.00 | n.a. | n.a. | n.a. |
| Uganda | 0.00 | 8.95 | n.a. | n.a. |
| Zambia | 0.00 | 21.59 | n.a. | n.a. |
| Zimbabwe | n.a. | 47.02 | n.a. | n.a. |
| **World** | **0.94** | **0.64** | **0.50** | **0.03** |

Sources: GIZ; IEA, *World Energy Outlook 2012;* IMF staff estimates; IMF, *World Economic Outlook;* OECD; World Bank.
Note: Values are rounded to the nearest one-hundredth percent; electricity subsidies are taken from 2009 for 31 countries, and natural gas data are taken from 2010 for four countries. World estimates are calculated as identified subsidies divided by global government revenues. n.a. = not applicable; CEE-CIS = Central and Eastern Europe and Commonwealth of Independent States; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa.
[1]These subsidy estimates may differ from those in the country budget documents because of the methodologies described in this appendix.

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**TABLE A.4**

Posttax Subsidies as Percent of GDP for Petroleum Products, Electricity, Natural Gas, and Coal, 2011[1]
*(Countries sorted by income category and region)*

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Advanced** | | | | |
| Australia | 0.61 | n.a. | 0.19 | 0.68 |
| Austria | 0.04 | n.a. | 0.17 | 0.20 |
| Belgium | 0.58 | n.a. | 0.29 | 0.11 |
| Canada | 1.16 | n.a. | 0.47 | 0.26 |
| Cyprus | 0.09 | n.a. | n.a. | 0.01 |
| Czech Republic | 0.00 | n.a. | 0.37 | 1.75 |
| Denmark | 0.00 | n.a. | 0.11 | 0.22 |
| Estonia | 0.00 | n.a. | 0.21 | 3.34 |
| Finland | 0.00 | n.a. | 0.11 | 0.42 |
| France | 0.01 | n.a. | 0.14 | 0.08 |
| Germany | 0.01 | n.a. | 0.19 | 0.56 |
| Greece | 0.09 | n.a. | 0.11 | 0.58 |
| Hong Kong SAR | 0.42 | n.a. | 0.12 | 0.85 |
| Iceland | 0.00 | n.a. | n.a. | 0.14 |
| Ireland | 0.00 | n.a. | 0.19 | 0.27 |
| Israel | 0.00 | n.a. | 0.15 | 0.69 |
| Italy | 0.00 | n.a. | 0.31 | 0.14 |
| Japan | 0.10 | n.a. | 0.17 | 0.41 |
| Korea | 0.06 | n.a. | 0.34 | 1.55 |
| Luxembourg[2] | 2.62 | n.a. | 0.17 | 0.03 |
| Malta | 0.00 | n.a. | n.a. | n.a. |
| Netherlands | 0.00 | n.a. | 0.42 | 0.20 |
| New Zealand | 0.77 | n.a. | 0.18 | 0.20 |
| Norway | 0.01 | n.a. | 0.11 | 0.04 |
| Portugal | 0.00 | n.a. | 0.17 | 0.19 |
| Singapore | 0.49 | n.a. | 0.27 | 0.01 |
| Slovak Republic | 0.00 | n.a. | 0.50 | 0.79 |
| Slovenia | 0.00 | n.a. | 0.13 | 0.64 |
| Spain | 0.00 | n.a. | 0.18 | 0.21 |
| Sweden | 0.00 | n.a. | 0.02 | 0.09 |
| Switzerland | 0.00 | n.a. | 0.04 | 0.01 |
| Taiwan Province of China | n.a. | 0.28 | 0.25 | 2.06 |
| United Kingdom | 0.01 | n.a. | 0.32 | 0.28 |
| United States | 1.58 | n.a. | 0.36 | 0.78 |
| **CEE-CIS** | | | | |
| Albania | 0.00 | n.a. | 0.01 | 0.02 |
| Armenia | 0.93 | 0.40 | 1.19 | n.a. |
| Azerbaijan | 2.39 | 0.91 | 2.19 | 0.00 |
| Belarus | 0.00 | 1.08 | 3.54 | n.a. |
| Bosnia and Herzegovina | 0.00 | n.a. | 0.11 | 4.66 |
| Bulgaria | 0.00 | n.a. | 0.38 | 2.91 |
| Croatia | 0.00 | n.a. | 0.45 | 0.29 |
| Georgia | 0.86 | n.a. | 0.61 | 0.08 |
| Hungary | 0.00 | n.a. | 0.78 | 0.39 |
| Kazakhstan | 2.36 | 0.97 | 1.32 | 3.64 |
| Kosovo | 0.00 | n.a. | n.a. | 0.02 |
| Kyrgyz Republic | 7.28 | 5.71 | 0.40 | 1.94 |
| Latvia | 0.00 | n.a. | 0.58 | 0.14 |
| Lithuania | 0.00 | n.a. | 0.55 | 0.14 |
| Macedonia, FYR | 0.00 | n.a. | 0.13 | 1.77 |
| Moldova | 0.00 | n.a. | 2.16 | 0.17 |

(Continued)

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**TABLE A.4 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **CEE-CIS (concluded)** | | | | |
| Mongolia | 0.00 | n.a. | n.a. | 6.36 |
| Montenegro, Rep. of | 0.00 | n.a. | n.a. | 0.00 |
| Poland | 0.00 | n.a. | 0.26 | 2.33 |
| Romania | 0.00 | n.a. | 0.58 | 0.74 |
| Russia | 1.64 | 1.27 | 3.07 | 1.36 |
| Serbia | 0.00 | n.a. | 0.52 | 3.33 |
| Tajikistan | 0.16 | 2.50 | 0.32 | 0.20 |
| Turkey | 0.00 | n.a. | 0.45 | 0.86 |
| Turkmenistan | 8.59 | 2.39 | 21.94 | n.a. |
| Ukraine | 0.31 | 1.85 | 8.24 | 3.71 |
| Uzbekistan | 1.10 | 5.95 | 28.03 | 0.38 |
| **Emerging and Developing Asia** | | | | |
| Afghanistan | 0.14 | 0.19 | n.a. | n.a. |
| Bangladesh | 1.46 | 3.01 | 2.94 | 0.12 |
| Bhutan | 1.36 | n.a. | n.a. | n.a. |
| Brunei Darussalam | 6.06 | 1.36 | 1.64 | 0.00 |
| Cambodia | 0.00 | n.a. | n.a. | 0.00 |
| China | 0.00 | 0.30 | 0.13 | 4.41 |
| Fiji | 0.16 | n.a. | n.a. | n.a. |
| India | 2.02 | 0.36 | 0.41 | 2.63 |
| Indonesia | 3.47 | 0.72 | 0.44 | 0.65 |
| Kiribati | n.a. | n.a. | n.a. | n.a. |
| Lao P.D.R. | 0.00 | n.a. | n.a. | n.a. |
| Malaysia | 5.38 | 0.56 | 1.02 | 0.98 |
| Maldives | 1.74 | n.a. | n.a. | n.a. |
| Myanmar | 1.04 | n.a. | n.a. | n.a. |
| Nepal | 0.28 | n.a. | n.a. | 0.16 |
| Pakistan | 1.14 | 1.63 | 3.67 | 0.22 |
| Papua New Guinea | n.a. | n.a. | n.a. | n.a. |
| Philippines | 0.31 | 0.00 | 0.11 | 0.65 |
| Samoa | n.a. | n.a. | n.a. | n.a. |
| Solomon Islands | 0.00 | n.a. | n.a. | n.a. |
| Sri Lanka | 2.17 | 0.75 | 0.00 | 0.04 |
| Thailand | 1.54 | 1.76 | 0.99 | 1.06 |
| Timor-Leste | 0.05 | n.a. | n.a. | n.a. |
| Tonga | 0.00 | n.a. | n.a. | n.a. |
| Tuvalu | 0.00 | n.a. | n.a. | n.a. |
| Vanuatu | 0.00 | n.a. | n.a. | n.a. |
| Vietnam | 0.83 | 2.64 | 0.78 | 1.60 |
| **LAC** | | | | |
| Antigua and Barbuda | 1.77 | n.a. | n.a. | n.a. |
| Argentina | 0.35 | 1.15 | 1.56 | 0.13 |
| Bahamas, The | 1.57 | n.a. | n.a. | n.a. |
| Barbados | 0.61 | n.a. | n.a. | n.a. |
| Belize | 0.00 | n.a. | n.a. | n.a. |
| Bolivia | 5.18 | n.a. | 1.02 | n.a. |
| Brazil | 0.11 | n.a. | 0.11 | 0.10 |
| Chile | 1.36 | 0.00 | 0.12 | 0.42 |
| Colombia | 0.00 | 0.00 | 0.25 | 0.27 |
| Costa Rica | 0.47 | n.a. | n.a. | 0.03 |
| Dominica | 1.30 | n.a. | n.a. | n.a. |
| Dominican Republic | 0.06 | n.a. | 0.17 | 0.18 |
| Ecuador | 10.03 | 0.33 | 0.07 | 0.00 |
| El Salvador | 0.90 | 0.00 | 0.00 | 0.00 |

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**TABLE A.4 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **LAC (concluded)** | | | | |
| Grenada | 1.12 | n.a. | n.a. | n.a. |
| Guatemala | 0.87 | n.a. | n.a. | 0.48 |
| Guyana | 1.20 | n.a. | n.a. | n.a. |
| Haiti | n.a. | n.a. | n.a. | n.a. |
| Honduras | 0.67 | n.a. | n.a. | 0.01 |
| Jamaica | 0.60 | n.a. | n.a. | 0.06 |
| Mexico | 2.14 | 0.00 | 0.42 | 0.16 |
| Nicaragua | 0.11 | n.a. | n.a. | n.a. |
| Panama | 2.40 | n.a. | n.a. | 0.02 |
| Paraguay | 0.00 | n.a. | n.a. | n.a. |
| Peru | 0.33 | 0.00 | 0.36 | 0.04 |
| St. Kitts and Nevis | 1.35 | n.a. | n.a. | n.a. |
| St. Lucia | 0.99 | n.a. | n.a. | n.a. |
| St. Vincent and the Grenadines | 0.99 | n.a. | n.a. | n.a. |
| Suriname | 0.00 | n.a. | n.a. | n.a. |
| Trinidad and Tobago | 5.95 | n.a. | 6.51 | n.a. |
| Uruguay | 0.00 | n.a. | 0.02 | 0.00 |
| Venezuela | 8.31 | 1.27 | 1.25 | 0.00 |
| **MENA** | | | | |
| Algeria | 6.31 | 1.15 | 6.37 | 0.00 |
| Bahrain | 10.26 | 2.96 | 2.74 | n.a. |
| Djibouti | 0.24 | 0.51 | n.a. | n.a. |
| Egypt | 8.84 | 2.50 | 3.05 | 0.07 |
| Iran | 7.98 | 3.64 | 7.10 | 0.02 |
| Iraq | 14.91 | 1.57 | 0.34 | 0.00 |
| Jordan | 5.65 | 4.10 | 0.50 | n.a. |
| Kuwait | 7.01 | 3.12 | 2.05 | 0.00 |
| Lebanon | 3.93 | 4.61 | 0.24 | 0.15 |
| Libya | 9.11 | 2.33 | 1.90 | 0.00 |
| Mauritania | 1.06 | 0.93 | 0.80 | n.a. |
| Morocco | 3.04 | n.a. | 0.05 | 0.46 |
| Oman | 6.73 | 0.94 | 3.86 | n.a. |
| Qatar | 5.51 | 1.26 | 2.08 | 0.00 |
| Saudi Arabia | 13.57 | 2.79 | 0.96 | 0.00 |
| Sudan | 2.40 | n.a. | n.a. | n.a. |
| Syria | n.a. | n.a. | n.a. | n.a. |
| Tunisia | 2.75 | 2.43 | 1.01 | n.a. |
| United Arab Emirates | 3.58 | 2.04 | 4.67 | 0.04 |
| Yemen | 7.25 | 1.47 | 1.53 | n.a. |
| **Sub-Saharan Africa** | | | | |
| Angola | 2.65 | 0.31 | 0.05 | 0.00 |
| Benin | 0.47 | 2.01 | n.a. | n.a. |
| Botswana | 1.05 | 0.48 | n.a. | 0.45 |
| Burkina Faso | 0.33 | 0.94 | n.a. | n.a. |
| Burundi | 0.00 | n.a. | n.a. | n.a. |
| Cameroon | 2.57 | 2.41 | 0.07 | n.a. |
| Cape Verde | 0.00 | 2.57 | n.a. | n.a. |
| Central African Republic | 0.00 | n.a. | n.a. | n.a. |
| Chad | 0.00 | 0.02 | n.a. | n.a. |
| Comoros | n.a. | n.a. | n.a. | n.a. |
| Congo, Democratic Republic of the | 0.00 | 1.80 | 0.00 | 0.13 |
| Congo, Republic of | 2.21 | 2.66 | 0.01 | n.a. |
| Côte d'Ivoire | 0.00 | 2.96 | 0.56 | n.a. |
| Equatorial Guinea | 2.02 | n.a. | n.a. | n.a. |

(Continued)

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**TABLE A.4 (CONCLUDED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Sub-Saharan Africa (concluded)** | | | | |
| Eritrea | n.a. | n.a. | n.a. | n.a. |
| Ethiopia | 0.68 | 1.32 | n.a. | n.a. |
| Gabon | 0.88 | n.a. | 0.09 | n.a. |
| Gambia, The | 0.00 | n.a. | n.a. | n.a. |
| Ghana | 0.59 | 3.02 | n.a. | n.a. |
| Guinea | 0.00 | n.a. | n.a. | n.a. |
| Guinea-Bissau | 0.00 | n.a. | n.a. | n.a. |
| Kenya | 0.61 | 0.16 | n.a. | 0.01 |
| Lesotho | 0.05 | 0.94 | n.a. | n.a. |
| Liberia | 0.02 | n.a. | n.a. | n.a. |
| Madagascar | 0.45 | 0.98 | n.a. | n.a. |
| Malawi | 0.17 | 2.01 | n.a. | n.a. |
| Mali | 0.19 | 0.99 | n.a. | n.a. |
| Mauritius | 0.00 | n.a. | n.a. | n.a. |
| Mozambique | 0.27 | 5.07 | 0.13 | 0.02 |
| Namibia | 0.13 | 0.52 | n.a. | 0.10 |
| Niger | 0.24 | 0.17 | n.a. | n.a. |
| Nigeria | 2.16 | 1.34 | 0.28 | 0.00 |
| Rwanda | 0.00 | 0.39 | n.a. | n.a. |
| Senegal | 0.00 | 2.51 | 0.01 | 0.23 |
| Seychelles | 0.00 | n.a. | n.a. | n.a. |
| Sierra Leone | 0.63 | n.a. | n.a. | n.a. |
| South Africa | 0.40 | 0.73 | 0.00 | 3.24 |
| Swaziland | 0.00 | n.a. | n.a. | n.a. |
| São Tomé and Príncipe | 0.63 | n.a. | n.a. | n.a. |
| Tanzania | 0.00 | 2.26 | 0.27 | 0.04 |
| Togo | 0.85 | n.a. | n.a. | n.a. |
| Uganda | 0.00 | 1.45 | n.a. | n.a. |
| Zambia | 0.00 | 4.96 | n.a. | 0.00 |
| Zimbabwe | n.a. | 14.89 | n.a. | 3.08 |
| **World** | **1.04** | **0.26** | **0.54** | **1.02** |

Sources: GIZ; IEA, *World Energy Outlook 2012;* IMF staff estimates; IMF, *World Economic Outlook;* OECD; World Bank.
Note: Values are rounded to the nearest one-hundredth percent; electricity subsidies are taken from 2009 for 31 countries, and natural gas data are taken from 2010 for four countries. World estimates are calculated as identified subsidies divided by global GDP. n.a. = not applicable; CEE-CIS = Central and Eastern Europe and Commonwealth of Independent States; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa.
[1]Owing to the lack of systematic cross-country data, the subsidy estimates do not take into account certain charges and taxes for energy that are often rationalized on environmental grounds. Principally, these include regional or country-level carbon pricing programs, road user charges (e.g., mileage-based tolls for trucks in Germany), and excise taxes on electricity consumption and vehicle sales. For example, the European Union Emissions Trading System imposes a carbon tax on certain greenhouse gases that are emitted by factories, power plants, and other installations in the system. The current prevailing prices, however, are only a small fraction of estimated damages, and only about half of emissions are covered under the scheme. To take another example, incorporating the road user charges for diesel vehicles in New Zealand would lower our posttax energy subsidy estimates for that country by US$0.8 billion.
[2]The estimate for Luxembourg reflects, to a large extent, cross-border sales of petroleum products to neighboring countries, with buyers attracted by lower tax rates.

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**TABLE A.5**

Posttax Subsidies in Percent of Government Revenues for Petroleum Products, Electricity, Natural Gas, and Coal, 2011[1]
*(Countries sorted by income category and region)*

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Advanced** | | | | |
| Australia | 1.90 | n.a. | 0.60 | 2.14 |
| Austria | 0.07 | n.a. | 0.36 | 0.42 |
| Belgium | 1.18 | n.a. | 0.58 | 0.23 |
| Canada | 3.04 | n.a. | 1.22 | 0.68 |
| Cyprus | 0.22 | n.a. | n.a. | 0.02 |
| Czech Republic | 0.00 | n.a. | 0.91 | 4.33 |
| Denmark | 0.00 | n.a. | 0.21 | 0.40 |
| Estonia | 0.00 | n.a. | 0.48 | 7.57 |
| Finland | 0.00 | n.a. | 0.20 | 0.79 |
| France | 0.01 | n.a. | 0.27 | 0.16 |
| Germany | 0.03 | n.a. | 0.42 | 1.25 |
| Greece | 0.23 | n.a. | 0.28 | 1.41 |
| Hong Kong SAR | 1.74 | n.a. | 0.48 | 3.50 |
| Iceland | 0.00 | n.a. | n.a. | 0.33 |
| Ireland | 0.00 | n.a. | 0.55 | 0.79 |
| Israel | 0.00 | n.a. | 0.38 | 1.70 |
| Italy | 0.00 | n.a. | 0.68 | 0.31 |
| Japan | 0.34 | n.a. | 0.54 | 1.33 |
| Korea | 0.25 | n.a. | 1.46 | 6.63 |
| Luxembourg[2] | 6.33 | n.a. | 0.41 | 0.08 |
| Malta | 0.00 | n.a. | n.a. | n.a. |
| Netherlands | 0.00 | n.a. | 0.93 | 0.45 |
| New Zealand | 2.66 | n.a. | 0.62 | 0.68 |
| Norway | 0.02 | n.a. | 0.19 | 0.08 |
| Portugal | 0.00 | n.a. | 0.38 | 0.43 |
| Singapore | 1.97 | n.a. | 1.10 | 0.05 |
| Slovak Republic | 0.00 | n.a. | 1.54 | 2.43 |
| Slovenia | 0.00 | n.a. | 0.32 | 1.53 |
| Spain | 0.00 | n.a. | 0.51 | 0.58 |
| Sweden | 0.00 | n.a. | 0.04 | 0.19 |
| Switzerland | 0.00 | n.a. | 0.12 | 0.02 |
| Taiwan Province of China | n.a. | 1.48 | 1.34 | 10.94 |
| United Kingdom | 0.03 | n.a. | 0.86 | 0.76 |
| United States | 5.03 | n.a. | 1.16 | 2.49 |
| **CEE-CIS** | | | | |
| Albania | 0.00 | n.a. | 0.06 | 0.07 |
| Armenia | 4.25 | 1.81 | 5.44 | n.a. |
| Azerbaijan | 5.25 | 2.00 | 4.81 | 0.00 |
| Belarus | 0.00 | 2.58 | 8.43 | n.a. |
| Bosnia and Herzegovina | 0.00 | n.a. | 0.23 | 10.03 |
| Bulgaria | 0.00 | n.a. | 1.17 | 8.98 |
| Croatia | 0.00 | n.a. | 1.23 | 0.79 |
| Georgia | 3.04 | n.a. | 2.16 | 0.27 |
| Hungary | 0.00 | n.a. | 1.48 | 0.73 |
| Kazakhstan | 8.51 | 3.49 | 4.74 | 13.09 |
| Kosovo | 0.00 | n.a. | n.a. | 0.06 |
| Kyrgyz Republic | 21.84 | 17.13 | 1.19 | 5.83 |
| Latvia | 0.00 | n.a. | 1.62 | 0.38 |
| Lithuania | 0.00 | n.a. | 1.68 | 0.42 |
| Macedonia, FYR | 0.00 | n.a. | 0.44 | 6.16 |
| Moldova | 0.00 | n.a. | 5.89 | 0.46 |

(Continued)

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**TABLE A.5 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **CEE-CIS (concluded)** | | | | |
| Mongolia | 0.00 | n.a. | n.a. | 16.02 |
| Montenegro, Rep. of | 0.00 | n.a. | n.a. | 0.00 |
| Poland | 0.00 | n.a. | 0.68 | 6.06 |
| Romania | 0.00 | n.a. | 1.84 | 2.34 |
| Russia | 4.27 | 3.30 | 8.01 | 3.54 |
| Serbia | 0.00 | n.a. | 1.27 | 8.12 |
| Tajikistan | 0.65 | 10.04 | 1.28 | 0.81 |
| Turkey | 0.00 | n.a. | 1.29 | 2.48 |
| Turkmenistan | 45.59 | 12.67 | 116.38 | n.a. |
| Ukraine | 0.73 | 4.36 | 19.45 | 8.76 |
| Uzbekistan | 2.72 | 14.80 | 69.68 | 0.94 |
| **Emerging and Developing Asia** | | | | |
| Afghanistan | 0.66 | 0.86 | n.a. | n.a. |
| Bangladesh | 12.27 | 25.25 | 24.72 | 1.02 |
| Bhutan | 3.72 | n.a. | n.a. | n.a. |
| Brunei Darussalam | 9.73 | 2.19 | 2.64 | 0.00 |
| Cambodia | 0.00 | n.a. | n.a. | 0.01 |
| China | 0.00 | 1.34 | 0.58 | 19.45 |
| Fiji | 0.62 | n.a. | n.a. | n.a. |
| India | 10.91 | 1.97 | 2.21 | 14.17 |
| Indonesia | 19.46 | 4.04 | 2.45 | 3.65 |
| Kiribati | n.a. | n.a. | n.a. | n.a. |
| Lao P.D.R. | 0.00 | n.a. | n.a. | n.a. |
| Malaysia | 24.61 | 2.54 | 4.66 | 4.46 |
| Maldives | 5.57 | n.a. | n.a. | n.a. |
| Myanmar | 18.11 | n.a. | n.a. | n.a. |
| Nepal | 1.57 | n.a. | n.a. | 0.89 |
| Pakistan | 8.93 | 12.76 | 28.68 | 1.72 |
| Papua New Guinea | n.a. | n.a. | n.a. | n.a. |
| Philippines | 1.80 | 0.00 | 0.64 | 3.74 |
| Samoa | n.a. | n.a. | n.a. | n.a. |
| Solomon Islands | 0.00 | n.a. | n.a. | n.a. |
| Sri Lanka | 14.96 | 5.17 | 0.00 | 0.27 |
| Thailand | 6.80 | 7.77 | 4.38 | 4.68 |
| Timor-Leste | 0.06 | n.a. | n.a. | n.a. |
| Tonga | 0.00 | n.a. | n.a. | n.a. |
| Tuvalu | 0.00 | n.a. | n.a. | n.a. |
| Vanuatu | 0.00 | n.a. | n.a. | n.a. |
| Vietnam | 3.00 | 9.54 | 2.81 | 5.78 |
| **LAC** | | | | |
| Antigua and Barbuda | 8.58 | n.a. | n.a. | n.a. |
| Argentina | 0.95 | 3.08 | 4.18 | 0.34 |
| Bahamas, The | 8.75 | n.a. | n.a. | n.a. |
| Barbados | 1.70 | n.a. | n.a. | n.a. |
| Belize | 0.00 | n.a. | n.a. | n.a. |
| Bolivia | 14.31 | n.a. | 2.83 | n.a. |
| Brazil | 0.33 | n.a. | 0.30 | 0.28 |
| Chile | 5.49 | 0.00 | 0.50 | 1.70 |
| Colombia | 0.00 | 0.00 | 0.93 | 1.00 |
| Costa Rica | 3.38 | n.a. | n.a. | 0.19 |
| Dominica | 4.18 | n.a. | n.a. | n.a. |
| Dominican Republic | 0.45 | n.a. | 1.24 | 1.34 |

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**TABLE A.5 (CONTINUED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **LAC (concluded)** | | | | |
| Ecuador | 24.55 | 0.80 | 0.18 | 0.00 |
| El Salvador | 5.05 | 0.00 | 0.00 | 0.00 |
| Grenada | 5.02 | n.a. | n.a. | n.a. |
| Guatemala | 7.33 | n.a. | n.a. | 4.09 |
| Guyana | 4.33 | n.a. | n.a. | n.a. |
| Haiti | n.a. | n.a. | n.a. | n.a. |
| Honduras | 2.85 | n.a. | n.a. | 0.05 |
| Jamaica | 2.38 | n.a. | n.a. | 0.22 |
| Mexico | 9.69 | 0.00 | 1.88 | 0.74 |
| Nicaragua | 0.33 | n.a. | n.a. | n.a. |
| Panama | 9.65 | n.a. | n.a. | 0.06 |
| Paraguay | 0.00 | n.a. | n.a. | n.a. |
| Peru | 1.53 | 0.00 | 1.65 | 0.20 |
| St. Kitts and Nevis | 3.62 | n.a. | n.a. | n.a. |
| St. Lucia | 3.60 | n.a. | n.a. | n.a. |
| St. Vincent and the Grenadines | 3.79 | n.a. | n.a. | n.a. |
| Suriname | 0.00 | n.a. | n.a. | n.a. |
| Trinidad and Tobago | 16.19 | n.a. | 17.71 | n.a. |
| Uruguay | 0.00 | n.a. | 0.05 | 0.00 |
| Venezuela | 23.58 | 3.59 | 3.56 | 0.01 |
| **MENA** | | | | |
| Algeria | 15.91 | 2.89 | 16.08 | 0.00 |
| Bahrain | 36.25 | 10.44 | 9.67 | n.a. |
| Djibouti | 0.69 | 1.49 | n.a. | n.a. |
| Egypt | 40.16 | 11.35 | 13.87 | 0.32 |
| Iran | 32.17 | 14.66 | 28.62 | 0.09 |
| Iraq | 19.08 | 2.01 | 0.43 | 0.00 |
| Jordan | 21.36 | 15.49 | 1.90 | n.a. |
| Kuwait | 10.38 | 4.62 | 3.03 | 0.00 |
| Lebanon | 16.69 | 19.59 | 1.04 | 0.62 |
| Libya | 23.66 | 6.04 | 4.94 | 0.00 |
| Mauritania | 3.87 | 3.37 | 2.91 | n.a. |
| Morocco | 11.03 | n.a. | 0.19 | 1.68 |
| Oman | 16.26 | 2.27 | 9.33 | n.a. |
| Qatar | 14.30 | 3.26 | 5.38 | 0.00 |
| Saudi Arabia | 25.47 | 5.23 | 1.80 | 0.00 |
| Sudan | 12.83 | n.a. | n.a. | n.a. |
| Syria | n.a. | n.a. | n.a. | n.a. |
| Tunisia | 8.67 | 7.66 | 3.17 | n.a. |
| United Arab Emirates | 10.21 | 5.82 | 13.33 | 0.11 |
| Yemen | 29.54 | 5.99 | 6.23 | n.a. |
| **Sub-Saharan Africa** | | | | |
| Angola | 5.42 | 0.64 | 0.11 | 0.00 |
| Benin | 2.36 | 9.98 | n.a. | n.a. |
| Botswana | 3.54 | 1.64 | n.a. | 1.53 |
| Burkina Faso | 1.50 | 4.30 | n.a. | n.a. |
| Burundi | 0.00 | n.a. | n.a. | n.a. |
| Cameroon | 13.62 | 12.76 | 0.37 | n.a. |
| Cape Verde | 0.00 | 10.23 | n.a. | n.a. |
| Central African Republic | 0.00 | n.a. | n.a. | n.a. |
| Chad | 0.00 | 0.06 | n.a. | n.a. |
| Comoros | n.a. | n.a. | n.a. | n.a. |

(Continued)

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**TABLE A.5 (CONCLUDED)**

| Country | Petroleum products | Electricity | Natural gas | Coal |
|---|---|---|---|---|
| **Sub-Saharan Africa (concluded)** | | | | |
| Congo, Democratic Republic of the | 0.00 | 6.57 | 0.02 | 0.46 |
| Congo, Republic of | 5.20 | 6.25 | 0.03 | n.a. |
| Côte d'Ivoire | 0.00 | 14.59 | 2.79 | n.a. |
| Equatorial Guinea | 6.56 | n.a. | n.a. | n.a. |
| Eritrea | n.a. | n.a. | n.a. | n.a. |
| Ethiopia | 4.06 | 7.89 | n.a. | n.a. |
| Gabon | 3.13 | n.a. | 0.32 | n.a. |
| Gambia, The | 0.00 | n.a. | n.a. | n.a. |
| Ghana | 3.03 | 15.50 | n.a. | n.a. |
| Guinea | 0.00 | n.a. | n.a. | n.a. |
| Guinea-Bissau | 0.00 | n.a. | n.a. | n.a. |
| Kenya | 2.44 | 0.66 | n.a. | 0.04 |
| Lesotho | 0.10 | 1.77 | n.a. | n.a. |
| Liberia | 0.07 | n.a. | n.a. | n.a. |
| Madagascar | 4.01 | 8.73 | n.a. | n.a. |
| Malawi | 0.58 | 6.83 | n.a. | n.a. |
| Mali | 0.82 | 4.24 | n.a. | n.a. |
| Mauritius | 0.00 | n.a. | n.a. | n.a. |
| Mozambique | 0.90 | 16.89 | 0.44 | 0.07 |
| Namibia | 0.45 | 1.82 | n.a. | 0.34 |
| Niger | 1.24 | 0.88 | n.a. | n.a. |
| Nigeria | 7.33 | 4.55 | 0.94 | 0.00 |
| Rwanda | 0.00 | 1.50 | n.a. | n.a. |
| Senegal | 0.00 | 11.22 | 0.04 | 1.02 |
| Seychelles | 0.00 | n.a. | n.a. | n.a. |
| Sierra Leone | 3.71 | n.a. | n.a. | n.a. |
| South Africa | 1.46 | 2.65 | 0.00 | 11.79 |
| Swaziland | 0.00 | n.a. | n.a. | n.a. |
| São Tomé and Príncipe | 1.70 | n.a. | n.a. | n.a. |
| Tanzania | 0.00 | 10.23 | 1.24 | 0.17 |
| Togo | 3.96 | n.a. | n.a. | n.a. |
| Uganda | 0.00 | 9.79 | n.a. | n.a. |
| Zambia | 0.00 | 22.07 | n.a. | 0.00 |
| Zimbabwe | n.a. | 48.22 | n.a. | 9.96 |
| **World** | **3.12** | **0.77** | **1.61** | **3.04** |

Sources: GIZ; IEA, *World Energy Outlook 2012;* IMF staff estimates; IMF, *World Economic Outlook;* OECD; World Bank.
Note: Values are rounded to the nearest one-hundredth percent; electricity subsidies are taken from 2009 for 31 countries, and natural gas data are taken from 2010 for four countries. World estimates are calculated as identified subsidies divided by global government revenues. n.a. = not applicable; CEE-CIS = Central and Eastern Europe and Commonwealth of Independent States; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa.
[1]Owing to the lack of systematic cross-country data, the subsidy estimates do not take into account certain charges and taxes for energy that are often rationalized on environmental grounds. Principally, these include regional or country-level carbon pricing programs, road user charges (e.g., mileage-based tolls for trucks in Germany), and excise taxes on electricity consumption and vehicle sales. For example, the European Union Emissions Trading System imposes a carbon tax on certain greenhouse gases that are emitted by factories, power plants, and other installations in the system. The current prevailing prices, however, are only a small fraction of estimated damages, and only about half of emissions are covered under the scheme. To take another example, incorporating the road user charges for diesel vehicles in New Zealand would lower our posttax energy subsidy estimates for that country by US$0.8 billion.
[2]The estimate for Luxembourg reflects, to a large extent, cross-border sales of petroleum products to neighboring countries, with buyers attracted by lower tax rates.

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# Appendix B. Assessing the Environmental and Health Impacts of Energy Subsidy Reform

IAN PARRY AND BAOPING SHANG

This appendix describes the methodologies used to provide calculations of the impact of energy subsidy reform on $CO_2$ emissions, $SO_2$ emissions, and other local pollutants. Here we consider a scenario in which energy prices are raised to levels that would eliminate tax-inclusive subsidies for petroleum products, coal, natural gas, and electricity. For each product, after calculating the increase in prices that is needed to eliminate tax-inclusive subsidies, we estimate how much the quantity demanded decreases for the product. The decrease in quantity demanded is determined by the assumption for the elasticity of demand for the product. The details on how this is estimated for each product are described below.

## PETROLEUM PRODUCTS

### $CO_2$ Emissions

A price elasticity of −0.4 is assumed for gasoline, diesel, and kerosene (Parry, 2011). The reduction in $CO_2$ emissions is then calculated by multiplying the reduction in consumption by the $CO_2$ coefficient of 0.0023 tons per liter of gasoline. The $CO_2$ coefficient is assumed to be 16 percent higher for diesel and kerosene (Parry, 2011).

### Local Pollution

The reduction (in percentage terms) in other local pollutants owing to fossil fuel combustion is approximated by the reduction in fuel consumption. Gasoline combustion produces only a small amount of $SO_2$, and thus the impact of petroleum subsidy removal on $SO_2$ is not estimated.



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## COAL

### $CO_2$ Emissions

The reduction (in percent) in coal consumption is calculated by assuming a price elasticity of −0.2 (Energy Information Administration [EIA], 2012).[1] The reduction in $CO_2$ emissions resulting from the removal of coal subsidies is then estimated as the same reduction (in percent) in total $CO_2$ emissions from coal, based on Organisation for Economic Co-operation and Development (OECD) data.

### $SO_2$ Emissions

This is estimated by using an $SO_2$ coefficient of 0.01 tons of $SO_2$ per short ton of coal (EIA, 2012; Environmental Protection Agency, 2012). Local pollution other than $SO_2$ from coal is considered minor.

## NATURAL GAS

The reduction (in percent) in natural gas consumption is calculated by assuming a price elasticity of −0.3 (EIA, 2012). The reduction in $CO_2$ emissions is then estimated as the same percent reduction in total $CO_2$ emissions from natural gas, based on OECD data. As noted previously, the impact of natural gas use on local pollution is assumed to be relatively small.

## ELECTRICITY

Electricity subsidies increase the consumption of coal, natural gas, and other generation fuels because of excess demand for electricity. However, for the following reasons, these effects on emissions are not quantified in this paper:

1. In some countries, part of the electricity subsidies is due to inefficiencies in the electricity sector. In other words, part of the problem is not that prices are too low but that costs are too high. Thus, successful subsidy reforms could reduce these inefficiencies without raising prices and suppressing demand.
2. Data limitations make it difficult to quantify the environmental impact of electricity subsidy removal. For example, price and cost data are limited, and there is a lack of information on the marginal energy source for electricity generation, which may be different from the average.
3. The environmental impact of price increases in fuel, coal, and natural gas as inputs for electricity generation is already incorporated in the calculations of these energy products. In addition, electricity subsidies are relatively small as a share of total posttax subsidies, so this omission is expected to have only a small impact on the overall estimates.

[1]An upward adjustment is made to the EIA estimate because it is generally viewed as being on the conservative side.

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## CAVEATS

The methods used here are used to provide some rough estimates of the magnitude of the impacts over the longer term. They have several limitations. For example, they do not take into account the substitution between different energy products and resulting offsetting effects (e.g., there could be some offsetting increase in emissions if subsidy removal raises the price of natural gas to coal).

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