CHAPTER 2

Defining and Measuring Energy Subsidies

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DEFINITION AND MEASUREMENT

Energy subsidies comprise both consumer and producer subsidies. Consumer subsidies arise when the prices paid by consumers, including both firms (intermediate consumption) and households (final consumption), are below supply costs, including transport and distribution costs. Producer subsidies arise when prices are above this level.[1] Where an energy product is internationally traded, such as for petroleum products, the supply cost is based on the international price.[2] For a net importer of fuel products, the supply cost is the overall cost of importing the fuel, whereas for a net exporter, the supply cost represents the forgone revenue, or opportunity cost, from not exporting the product.

Where the energy product is mostly nontraded (such as electricity in most countries), the relevant supply cost is the cost-recovery price for the domestic producer, including a normal return to capital and distribution costs. This approach to measuring consumer subsidies is often referred to as the "price-gap approach" (Koplow, 2009) and is used widely in analyses by other international agencies. In most economies, there are elements of both producer and consumer subsidies, although in practice it may be difficult to separate the two. The advantage of the price-gap approach is that it also helps capture consumer subsidies that are implicit, such as those provided by oil-exporting countries that supply petroleum products to their populations at prices below those prevailing in international markets.

Consumer subsidies include two components: a pretax subsidy, if the price paid by firms and households is below supply and distribution costs, and a tax subsidy, if taxes are below their efficient level. Box 2.1 describes the calculation of these two components. Most economies impose consumption taxes to raise revenue to help finance public expenditures. Efficient taxation requires that all consumption, including that of energy products, be subject to this taxation. The efficient taxation

[1]The calculation of producer subsidies should incorporate any subsidies received on inputs.
[2]For some exporters of fuel products with refineries that use domestic crude oil, actual fuel product production costs may be below supply costs if these exporters have access to subsidized crude oil.

Box 2.1 Pretax and Posttax Consumer Subsidies

A consumer subsidy is defined as the difference between the supply cost of an energy product, including transport and distribution costs, and the price paid by energy consumers (including both households for final consumption and enterprises for intermediate consumption). There are two concepts of consumer subsidies: pretax subsidies and posttax subsidies.

For the calculation of pretax subsidies for internationally traded goods (such as the refined petroleum products considered in this book), the supply cost is the international price including transport and distribution costs[1] (*Pw*), so that

$$\text{Pretax subsidy} = Pw - Pc,$$

where *Pc* is the price paid by consumers. When the good or service is not traded internationally, as is the case for electricity in most countries, then the supply cost is taken as the cost-recovery price (e.g., the costs of generation, transmission, and distribution of electricity). The pretax subsidy is then calculated as above, but *Pw* is the cost-recovery price. Pretax subsidies exist only in countries where the price paid by consumers is below the supply cost ($Pc < Pw$).

The calculation of posttax subsidies includes an adjustment for efficient taxation ($t^* > 0$) to reflect both revenue needs and a correction for negative consumption externalities:

$$\text{Posttax subsidy} = (Pw + t^*) - Pc,$$

where *Pw* and *Pc* are defined as above. Therefore, when there is a pretax subsidy, the posttax subsidy is equal to the efficient tax plus the pretax subsidy. When there is no pretax subsidy, the posttax subsidy is equal to the difference between efficient and actual taxation.

[1]When the refined petroleum product is imported, the supply cost is taken as the international fob price plus the cost of transporting the product to the country's border plus the cost of internal distribution. When the product is exported, the supply cost is defined as the revenue forgone by not exporting the product, that is, the international fob price minus the cost of transporting the product abroad (because this cost is saved when the product is consumed domestically rather than exported) plus the cost of internal distribution.

of energy further requires corrective taxes to capture negative environmental and other externalities owing to energy use, such as global warming and local pollution.[3] The discussion below focuses on both pretax subsidies and posttax subsidies, where the latter includes an allowance for efficient taxation.

Although energy subsidies do not always appear on the budget, they must ultimately be paid by someone. Whether and how subsidies are reflected in the budget will depend on who incurs them and how they are financed. For example, the cost of pretax consumer subsidies may be incurred by state-owned enterprises

[3]These taxes are often referred to as "Pigouvian" or "corrective" taxes. In this paper, only broad estimates of these tax subsidies will be reported. A forthcoming study by the Fiscal Affairs Department of the IMF will provide more refined, country-specific estimates.

(SOEs) that sell electricity or petroleum products at a price below supply costs. If the government fully finances these losses with a transfer, the consumer subsidy will be reflected in the budget as expenditure and financed through higher taxes, increased debt, or higher inflation if the debt is monetized. In many instances, however, the subsidy may be financed by the SOE and reflected in its operating losses or lower profits, lower tax payments to the government, the accumulation of payment arrears to its suppliers, or a combination of all three.

Alternatively, the cost of consumer subsidies could be offset by subsidized access to energy inputs, the cost of which would again fall on the government. In practice, the ways in which subsidies are financed and recorded in the budget vary across countries and can change over time. For example, whereas Indonesia, Jordan, and Malaysia fully record fuel subsidies in the budget, Sudan and Yemen only partially record subsidies, and all subsidies are off budget in Angola. In India, the extent to which fuel subsidies are recorded on budget has varied (Box 2.2). In sum, in one way or another, someone always pays the cost of subsidies.

Pretax Subsidies

Subsidies for petroleum products are calculated for 176 countries using the price-gap approach drawing on data compiled by IMF staff, the Organisation for Economic Co-operation and Development (OECD), and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) for 2000–2011. Consumer subsidies

Box 2.2 Financing Fuel Subsidies in India

Domestic fuel prices in India have not kept pace with rising international fuel costs, resulting in consumer price subsidies. Reflecting sharp increases in fuel import prices over 2007 and 2008, subsidies peaked at over 2 percent of GDP in fiscal year (FY) 2008/09. As international prices collapsed over the second half of 2008, subsidies also fell sharply to just under 0.9 percent of GDP in FY 2009/10. However, with the rebound in international prices over the last three years, subsidies again started to escalate, reaching nearly 2 percent of GDP in FY 2011/12.

Fuel subsidies have been financed through a number of channels, including off-budget sources. Subsidies are incurred in the first instance by the predominantly state-owned oil marketing companies (OMCs), which sell fuel products to consumers at subsidized prices. These losses incurred by OMCs have been financed in a variety of ways. In FY 2007/08, just under one-half of the financing was recorded on budget, with the remaining half financed off budget. On-budget transfers mainly took the form of so-called government oil bonds issued to OMCs, whereas direct budget transfers to OMCs were negligible. Off-budget financing was split between transfers from state-owned enterprises involved in the upstream production of crude oil and OMCs' self-financing. In effect, OMCs used part of the profits from the sale of other unregulated fuel products to offset these subsidy losses. By FY 2011/12, all on-budget financing took the form of direct budget transfers to OMCs, which accounted for about three-fifths of subsidies, with the remainder financed by upstream transfers.

are estimated for gasoline, diesel, and kerosene. Producer subsidies are included for 12 OECD countries. See Appendix A for details.

Natural gas and coal subsidies are estimated for 56 countries and are largely based on the price-gap approach. These data are mostly drawn from the IEA for 2007–11. Producer subsidies are also included for coal for 16 OECD countries.

A number of different methods are used to estimate electricity subsidies for 77 countries. For some countries in Africa, the Middle East, and emerging Europe, estimates of combined producer and consumer subsidies are compiled from various World Bank and IMF reports. For these countries, subsidy estimates are based on average domestic prices and cost-recovery prices that cover production and investment costs as well as distributional losses and the nonpayment of electricity bills. For other countries, consumer price subsidies are taken from IEA, which derived these values on the basis of the price-gap approach.

Posttax Subsidies

The supply cost was also adjusted for corrective taxes and revenue considerations to estimate posttax subsidies. Rough estimates of corrective taxes, drawing on other studies, were made to account for the effects of energy consumption on global warming; on public health through the adverse effects on local pollution; on traffic congestion and accidents; and on road damage. Estimates of the global warming damages from CO_2 emissions vary widely (see Appendix A). Our estimates assume damages from global warming of US$36 per ton of CO_2 emissions, following the United States Interagency Working Group on Social Cost of Carbon (2013), an extensive and widely reviewed study. For final consumption, posttax subsidy estimates also assume that energy products are subject to the economy's standard consumption tax rate (an ad valorem tax) on top of the corrective tax. The estimates are based on value added tax (VAT) rates for 150 countries in 2011. For countries without a VAT, the average VAT rate of countries in the region with a similar level of income is assumed.

Caveats

These estimates are likely to underestimate energy subsidies and should be interpreted with caution. First, data on producer subsidies are not available for all countries and all products.[4] Second, consumer subsidies for liquefied petroleum gas (LPG) are not included owing to lack of data. Third, fuel subsidy estimates are based on a snapshot of prices paid by firms and households at a point in time (end-of-year) or as an average of end-of-quarter prices when such data are available. Fourth, for electricity, natural gas, and coal, estimates lack full comparability across countries, because they are drawn from different sources and use different approaches. Fifth, they rely on the assumption of similar transportation and distribution margins across countries. Sixth, in light of these factors, our

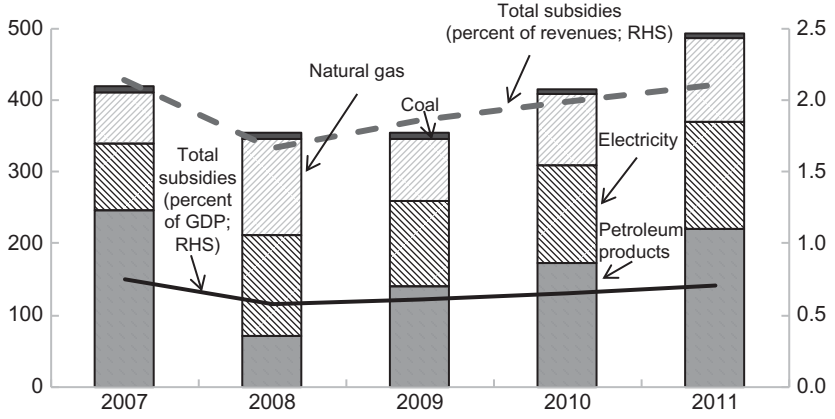
[4]In practice, identifying producer subsidies can be especially difficult because these often take the form of differential tax treatment and tax exemptions for specific sectors.

subsidy estimates may differ from those found in country budget documents, including those reported in the case studies. Seventh, the estimates of corrective taxes are made on the basis of studies for just a few countries and a common assumption regarding how these would vary with country income levels. However, these weaknesses are outweighed by the merits of constructing a broad picture of the magnitude of energy subsidies across as many countries and products as possible.

PRETAX SUBSIDIES

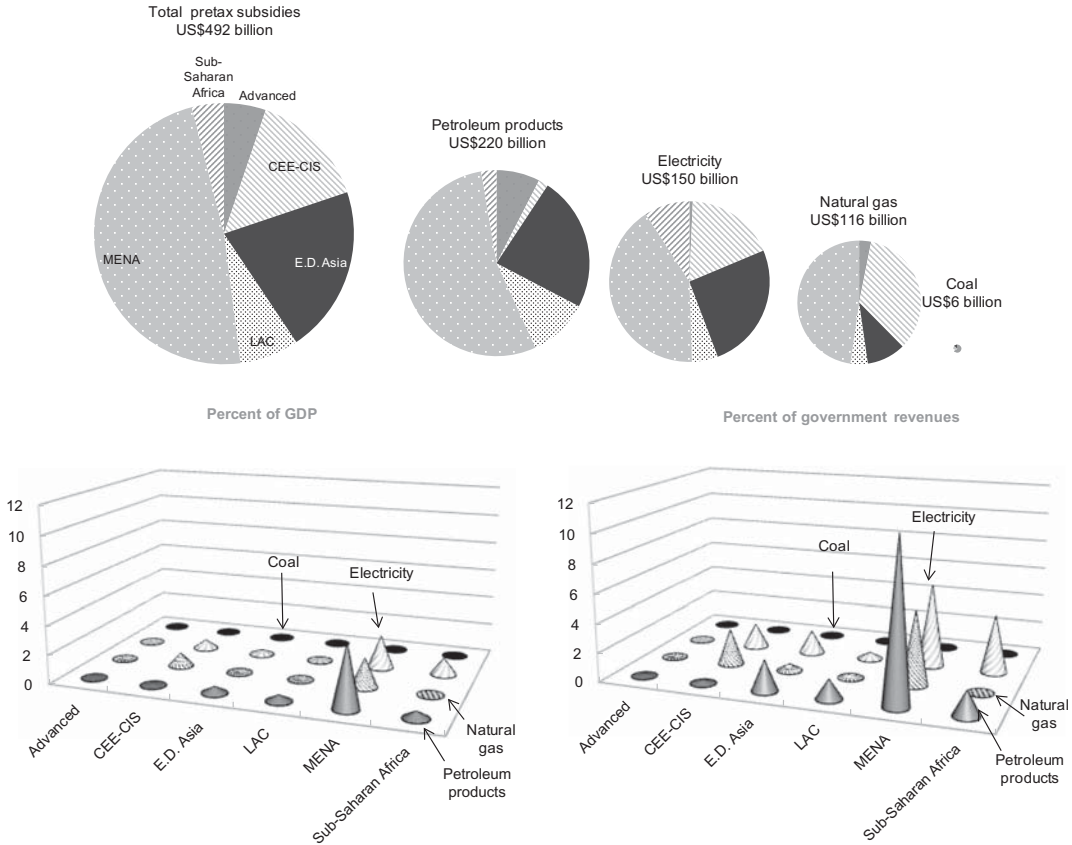
Magnitude of Energy Subsidies

Global pretax energy subsidies are significant. The subsidy estimates capture both those that are explicitly recorded in the budget and those that are implicit and off budget. The evolution of energy subsidies closely mimics that of international energy prices (Figure 2.1). Although subsidies declined with the collapse of international energy prices, they have started to escalate since 2009. In 2011, global pretax subsidies reached US$492 billion (0.7 percent of global GDP or over 2 percent of total government revenues). Petroleum and electricity subsidies accounted for about 45 percent and 30 percent of the total, respectively, with most of the remainder coming from natural gas. Coal subsidies are relatively small at US$6.5 billion.



Sources: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); IMF staff estimates; IMF, *World Economic Outlook* (WEO); International Energy Agency (IEA), *World Energy Outlook 2012*; OECD; World Bank.
Note: Data are based on most recent year available. Total subsidies in percent of GDP and revenues are calculated as total identified subsidies divided by global GDP and revenues, respectively.

Figure 2.1 Pretax Energy Subsidies, 2007–11 (Billions of U.S. dollars)
Energy subsidies have surged since the 2008–9 crisis and closely mimic changes in international prices.



Sources: GIZ; IEA, *World Energy Outlook 2012;* IMF, WEO; IMF staff estimates; OECD; World Bank.
Note: Data for electricity are for the most recent year available. Subsides in percent of GDP and revenues are calculated as identified subsidies divided by regional GDP and revenues, respectively. CEE-CIS = Central and Eastern Europe and Commonwealth of Independent States; E.D. Asia = Emerging and Developing Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa.

Figure 2.2 Pretax Energy Subsidies by Region, 2011
Energy subsidies are concentrated mostly in the Middle East and North Africa, Central and Eastern Europe, and Emerging and Developing Asia.

The Geography of Pretax Subsidies

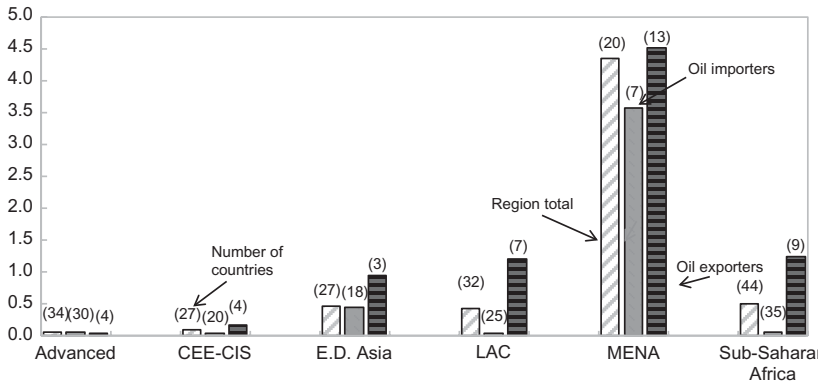
Pretax subsidies are concentrated in developing and emerging economies. Oil exporters—most of which are developing or emerging economies—tend to have the largest subsidies. This finding holds not only when measuring subsidies in absolute terms but also as a share of GDP and on a per capita basis.

The *Middle East and North Africa* region accounted for about 48 percent of global energy subsidies (Figure 2.2, Appendix Table A.2). Energy subsidies totaled over 8.5 percent of regional GDP or 22 percent of total government revenues, with one-half reflecting petroleum product subsidies. The regional average masks significant variation across countries. Of the 20 countries in the region, 12 have energy subsidies of 5 percent of GDP or more. Subsidies are high in this region for both oil exporters and oil importers (Figure 2.3).

Countries in *Emerging and Developing Asia* were responsible for over 20 percent of global energy subsidies. They amounted to nearly 1 percent of regional GDP or 4 percent of total government revenues, with petroleum products and electricity accounting for nearly 90 percent of subsidies. Energy subsidies exceeded 3 percent of GDP in four countries: Bangladesh, Brunei, Indonesia, and Pakistan.

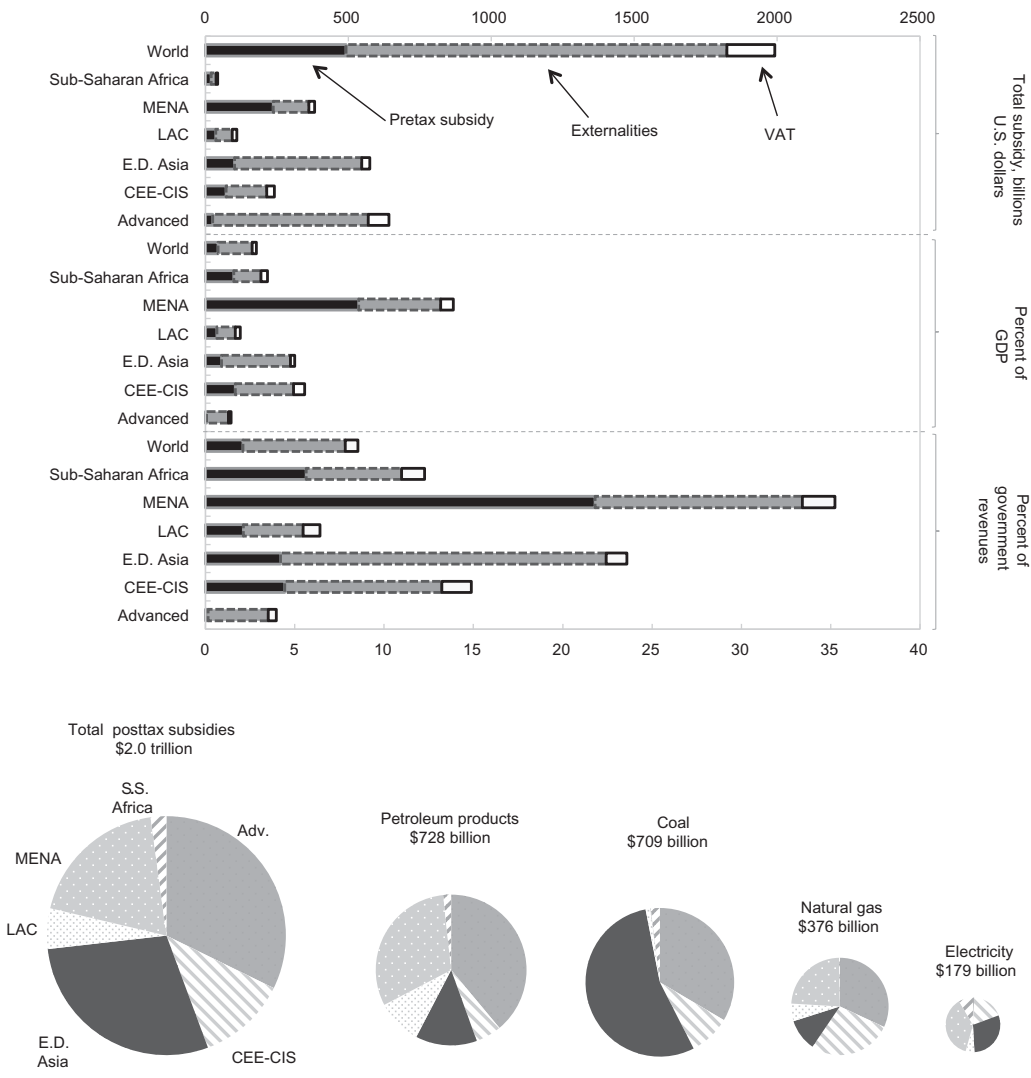
The *Central and Eastern Europe and CIS* countries accounted for about 15 percent of global energy subsidies, including the highest share (at nearly 35 percent) of global natural gas subsidies. Energy subsidies amounted to over 1.5 percent of regional GDP or 4.5 percent of total government revenues, with natural gas and electricity accounting for about 95 percent. They exceeded 5 percent of GDP in four countries: Kyrgyz Republic, Turkmenistan, Ukraine, and Uzbekistan.

Latin America and the Caribbean made up about 7.5 percent of global energy subsidies (approximately 0.5 percent of regional GDP or 2 percent of total government



Sources: GIZ; IEA, *World Energy Outlook 2012;* IMF, WEO; IMF staff estimates; OECD; World Bank.
Note: Subsidies in percent of GDP are calculated as identified subsidies divided by regional GDP. Number of countries in each category are indicated in parentheses.

Figure 2.3 Pretax Petroleum Subsidies among Petroleum Importing and Exporting Countries, 2011 (Percent of GDP)
Petroleum product subsidies are systematically higher for oil exporters.



Sources: GIZ; IEA, *World Energy Outlook 2012;* IMF, WEO; IMF staff estimates; OECD; World Bank.
Note: VAT refers to the tax subsidy provided when energy products are taxed by less than the economy's standard VAT rate (see Appendix A). Estimates for electricity are for the most recent year available. Subsidies in percent of GDP and revenues are calculated as identified subsidies divided by global or regional GDP and revenues, respectively.

Figure 2.4 Adjustment of Energy Subsidies for Taxes and Externalities, 2011
Energy subsidies increase substantially when externalities and tax considerations are taken on board.

revenues), with petroleum subsidies accounting for nearly 65 percent. Energy subsidies exceeded 5 percent of GDP in two countries: Ecuador and Venezuela.

Sub-Saharan Africa accounted for about 4 percent of global energy subsidies. Energy subsidies amounted to 1.5 percent of regional GDP or 5.5 percent of total government revenues, with electricity subsidies accounting for over 70 percent. Total subsidies exceeded 4 percent of GDP in three countries: Mozambique, Zambia, and Zimbabwe.

The only advanced economies where energy subsidies were a nonnegligible share of GDP were Belgium at 0.5 percent of GDP (petroleum producer subsidies) and Taiwan Province of China at 0.3 percent of GDP (electricity).

In summary, pretax subsidies are pervasive and impose significant fiscal costs in most developing and emerging regions. They are most prominent in the Middle East and North Africa, especially among oil exporters. Given that energy consumption can be expected to rise as incomes grow, the size of subsidies could climb in regions where they currently account for a small share of the global total, such as sub-Saharan Africa.

POSTTAX SUBSIDIES

By definition, posttax energy subsidies are much larger than pretax subsidies, amounting to US$2.0 trillion in 2011—about 2.9 percent of global GDP or 8.5 percent of total government revenue.[5] Virtually all of the world's economies provide energy subsidies of some kind when measured on a tax-inclusive basis, including 34 advanced economies. For some products, such as coal, posttax subsidies are substantial because prices are far below the levels needed to address negative environmental and health externalities. The fact that energy products are taxed much less than other products also contributes to the high level of posttax subsidies. In the Middle East and North Africa, for example, applying the same rate of VAT or sales taxes to energy products as other goods and services would generate 0.75 percent of GDP. Of the global total, pretax subsidies account for about one-quarter, and tax subsidies account for about three-quarters (Figure 2.4). The advanced economies account for about 40 percent of the global total. The top three subsidizers across the world, in absolute terms, are the United States (US$410 billion), China (US$353 billion), and Russia (US$136 billion).

[5]The posttax subsidy figures are calculated by multiplying the subsidy per unit by the quantity of energy consumption in 2011. The revenues gained by eliminating subsidies would be lower than this amount because of the decline in the quantity of energy consumed.