

Egypt

Guiding Reform of Energy Subsidies Long-Term

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Abstract

This paper examines the short- and long-run economic impact of Egypt's energy subsidy reform in July 2014 (with-out and without compensating transfers for the bottom 40 percent of the income distribution) and the decline in global energy prices, as well as the long-run impact of phasing out the energy subsidies over a 5 year period. The analysis uses a Computable General Equilibrium model with 56 productive sectors, including 11 energy subsectors. The short-run analysis employs a two-stage factor market adjustment, with wages first fixed and then flexible. The long-run analysis is run in a recursive dynamic mode, capturing the impact of

improved productivity and increased investment resulting from more efficient allocation of resources and reduction in government deficits. In the short run, the 2014 reforms lead to slightly lower consumption while investment increases strongly and production shifts from highly subsidized energy-intensive sectors such as energy, water and sanitation, and transport to other sectors (notably construction). The impact on overall consumer prices is limited. In the longer run, real GDP growth increases by about one percentage point relative to the baseline before the 2014 reform.

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Egypt: Guiding Reform of Energy Subsidies¹

1. Introduction

The Egyptian government, like many of the countries in the MENA region, has employed relatively large energy subsidies for decades, justified as a means of augmenting the incomes of lower income and middle class households through low cost energy services. The costs of this program have grown significantly; particularly as international energy prices have increased or remained high, at least until recently. In 2013/14 combined energy subsidies amounted to about E£150 billion (\$21 billion) or 8.5% of GDP.

Egypt's energy subsidies were particularly wasteful and inefficient because below-market clearing controlled prices provided producers with below-cost inputs, resulting in overconsumption, distorted commodity markets, poor quality and unreliable services as well as enormous claims on public resources. In July 2014 the Egyptian government re-introduced major reforms to phase-out energy subsidies through a staged series of increases in the officially mandated prices for petroleum, gas and electricity.

Shortly thereafter, however, international oil prices began to fall sharply, to the point where oil prices are currently about 40% below previous years' averages. Lower international energy prices substantially reduced the gap between domestic and international prices and therefore lowered the cost and distortionary effects the subsidies being provided consumers and businesses.

This was clearly an opportune time to introduce these subsidy reforms. However, Egyptian policy makers cannot know when or to what extent international prices might increase again. (Market prices have recently increased somewhat, but analysts suggest that prices are as likely to continue to decline from current levels, as they are to increase). While the fall in international energy prices provides a supportive environment for the introduction of the July 2014 reforms, for these measures to be sustainable Egypt's policy makers must ensure

¹ Peter Griffin, James Robertson, and Thomas Laursen. Any views presented here are the authors alone and should not be attributed to the World Bank, the Egyptian Government or any other person or institution. Any shortcomings are the sole responsibility of the authors.

that any future changes in international prices are quickly and effectively reflected in domestic prices. (This should be done in such a way that subsidies at least do not increase).

The reform of energy subsidies will have a significant impact on the distribution of income. Subsidies are a proportionally important part of the real incomes of the poor, although in absolute terms they tend to benefit upper income groups more. There are key equity and political issues that concern whether the adverse impact of the removal of subsidies should be alleviated to some degree for the poor. In the analysis presented here, the economic impact of including offsetting transfers for the poorest 40% of Egyptian households is examined.

The full economic impact of the reforms will be determined by the dynamic long-term gains in economic efficiency achieved through a more productive allocation of the country's resources. The longer-term economic implications of the July 2014 reforms are examined in a dynamic context in the final section of this paper, including the impacts of further reforms (a virtually complete phase-out of subsidies) with and without a sustained reduction in oil prices.

The analysis presented here is based on a dynamic Computable General Equilibrium model that is used to assess both the short-term static and longer-term dynamic effects in terms of macroeconomic performance on major economic sectors and across broad income groups. The analysis makes clear that the July 2014 reforms represent an important first step by the Egyptian government and that further reforms would considerably increase and consolidate economic gains.

2. Egyptian Energy Price Subsidies

The Egyptian government has heavily subsidized energy through a number of channels, including through the prices of crude petroleum, natural gas, liquefied natural gas (LNG), gasoline, diesel fuel, fuel oil and electricity. More than one-half of the government's total amount of resources devoted to energy subsidies was applied to petroleum products, while approximately one-third was for electricity and 15% for natural gas. These distortions

have had far reaching effects across the entire Egyptian economy, with very uneven impacts depending upon the sector.

In the analysis presented here, subsidy rates were calculated as the differences between official prices and cost recovery unit prices for electricity and petroleum products. The subsidy for natural gas was calculated as the difference between official prices and average export prices for gas. The subsidies to refined petroleum products are derived from the governments zero price transfers of crude oil to refineries. The subsidies are calculated based on the value of crude oil transfers.

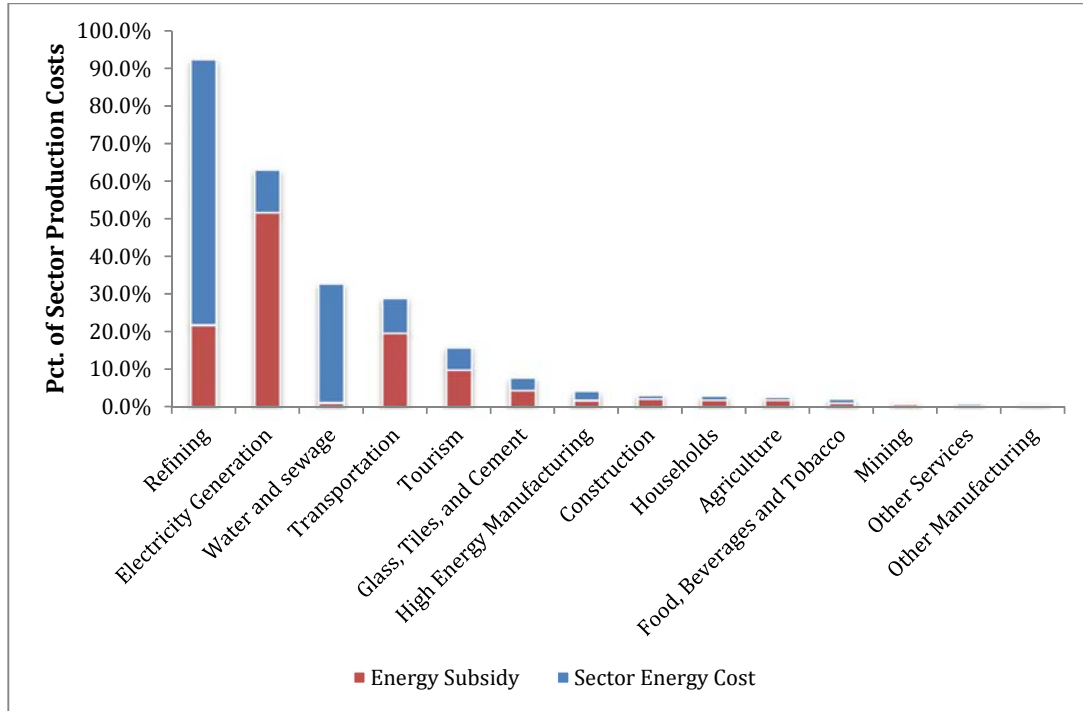
The distribution of the impacts of subsidies across sectors pre-reforms can be seen in Figure 1, where the intermediate costs of energy inputs were evaluated at subsidized energy prices and cost recovery prices, as appropriate. Energy-intensities and the impacts of the subsidies varies considerably across sectors:

- **Refineries:** subsidies, mainly zero-priced crude oil, are 24% of total costs;
- **Electricity Generation:** energy subsidies amount to 52% of total costs and 83% of energy costs;
- **Transportation:** energy is 29% of total costs, with subsidies covering 20% of energy costs;
- **Tourism:** energy inputs are 16% of total costs, with subsidies covering 10%;

The distribution of the different types of energy subsidies across sectors is illustrated in Figure 2. For example, the Electricity sector's subsidies originated mainly from natural gas and fuel oil used in power generation; the Refining sector subsidies were realized through the zero-priced crude oil provided by the government; and the Transportation sector's subsidies were obtained through the consumption of subsidized gasoline and diesel fuel. Direct subsidies to Households were primarily through the low prices for LNG and to a lesser extent from the consumption of electricity and natural gas. For other sectors, the main benefits were through the subsidies to diesel fuel, with manufacturing utilizing fuel oil subsidies and Service sectors receiving small natural gas subsidies. The highest rates of total energy subsidy were in the Electricity Generation, Refining and Transportations

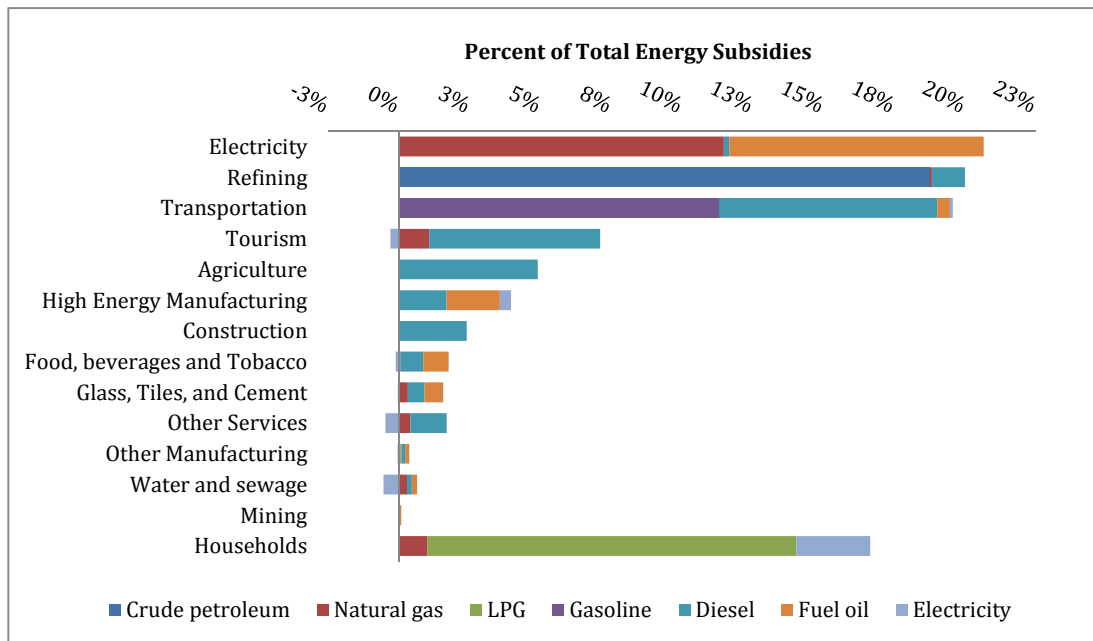
sectors, which we estimate to have received from 19.5% to 20.5% of subsidies. Households directly received 16.5% of the subsidies.

Figure 1: Energy Shares of Production Costs (2013/14)



Source: Authors calculations

Figure 2: Distribution of Energy Subsidies by Sectors and Energy Products



Source: Authors' calculations

The financial costs of energy subsidies are not treated in a transparent manner in the government's budget and are therefore not straightforward to estimate. Nevertheless, recent estimates suggest that these costs are substantial. For example, it has been estimated that between 2005/06 and 2009/10, the costs of petroleum subsidies alone increased by 65%, from E£40 billion (\$7.2 billion) to E£68 billion (\$11.9 billion).² The dynamic CGE model used in the analysis presented here suggests that in 2013/14, the total budgetary cost of all energy subsidies was approximately E£150 billion (\$21 billion) or about 8.5% of GDP.

The economic costs of energy subsidies go well beyond the direct budgetary costs, as a result of distorted consumption and investment decisions and the adverse economic impacts that these distortions have on productivity and growth. It has been estimated that the just the direct economic cost of these subsidies could have been as much as 11.9% of GDP in 2009/10.³

To put Egypt's experience in some context, the IMF has estimated that for the MENA region as a whole, energy subsidies cost about \$237 billion in 2011, which amounted to about 8.6% of regional GDP, or 22% of aggregate government revenue, and accounted for 48% of global energy subsidies.⁴ (These costs would have been higher in 2013/14 as a result of higher international energy prices). In addition, energy subsidies far exceeded the value of other subsidies provided in many MENA countries, (e.g., food subsidies are estimated to have amounted to 0.7% of GDP in 2011).

3. The Impacts of the July 2014 Reforms

In July 2014 the Egyptian government introduced a range of reforms through increases in official prices in order to significantly reduce fuel subsidies (Table 1.) The largest prices

² "Reforming Energy Subsidies in Egypt", African Development Bank, Vincent Castel, March 2012.

³ The estimate for the full economic cost of energy subsidies is derived from the gap between the actual prices charged and the corresponding reference prices for different sources of energy, taking into account transport costs, etc. (See Castel [2012].) The comparison for natural gas in that study was drawn from "Natural Gas Pricing in the countries of the Middle East and North Africa" by Hossain Razavi, *The Energy Journal*, 2009.

⁴ IMF: 'About one-half of total energy subsidies in MENA are accounted for by petroleum products, while the remainder represents subsidies on electricity and natural gas. There is a wide dispersion of subsidies in the region, with subsidies being more prevalent in oil exporters. Energy subsidies exceeded 5%.

increases were for natural gas, 122% for transport and 100% for residential users. In some cases, official prices were left unchanged. The government also committed to eliminate subsidies for electricity prices over the next five years through a phased doubling of prices.

Table 1: Energy Product Price Changes: July 2014

Natural Gas	High Energy Manufacturing	11%
	Refining	46%
	Glass, glass products and other non-metallic products	13%
	Other Manufacturing	76%
	Electricity Generation	79%
	Transport (Compressed Natural Gas)	122%
	Residential	100%
	Other	0%
Gasoline	80	67%
	92	35%
Fuel Oil	High Energy Manufacturing	0%
	Glass, glass products and other non-metallic products	23%
	Electricity Generation	0%
	Other	33%
Diesel		55%
LPG	Residential	0%
	Commercial	0%

These reforms were a response to the rapidly increasing costs of subsidies at a time when budget deficits were increasing – with energy and food subsidies amounting to more than 35% of the government’s budget and as much as 12.5% of GDP. Even with these initial reforms, subsidies would remain substantial; the budgetary cost of the subsidies would fall by only about one-third, from about E£150 billion to E£100 billion, and in the short-term the budget deficit would remain high, declining from 8% to 6% of GDP.

The framework used to assess the impacts of the July 2014 reforms indicated that there would be major effects on the allocation of consumption, investment and employment across sectors.⁵ They will also have significant effects on the distribution of income. Given the high political sensitivities throughout the region associated with reducing subsidies, it can be argued that the reforms would be more sustainable if the poor were partially compensated for the decline in real incomes due to increased domestic energy prices. In this

⁵ In some of the more capital and energy intensive sectors (i.e. electricity and refining) there are low returns to capital, and the data underlying the model only shows a weak correlation between energy use and capital use (correlation = 0.2). Consequently, the impact on overall wages or employment of the reforms are limited to about a 0.2% decline in employment in the short run, followed by 1% wage increases in the medium term.

analysis we examine the impacts of the reforms both with and without offsetting transfers to the poor, (i.e., the poor being defined in the context of the model as the 40% of the population with the lowest incomes).⁶ The impact of the reforms and the inclusion of potential offsetting transfers can be summarized as follows:

Table 2: Summary of Macroeconomic Impact of July 2014 Reforms

	Without Transfers	With Transfers
Total energy subsidies	-22.3%	-18.8%
Budget deficit	-20.9%	-20.8%
Real consumption	-1.4%	-1.0%
Investment	+13.3%	+10.6%

Source: Authors' calculations.

It is estimated that the July 2014 reforms without offsetting transfers would result in a reduction of energy subsidies and of the budget deficit by more than 20%; real consumption would fall by a small amount, 1.4%; and investment would increase substantially.

The macroeconomic impact of the offsetting transfers for the poor would be relatively limited. Relative to the impacts of the reforms without transfers, total real consumption would decline by 0.4% and there would be a 2.7% point decrease in investment. There would be virtually no impact on the change in the budget deficit. The transfers may, however, make the reforms more politically sustainable by mitigating the adverse impacts on the most vulnerable.

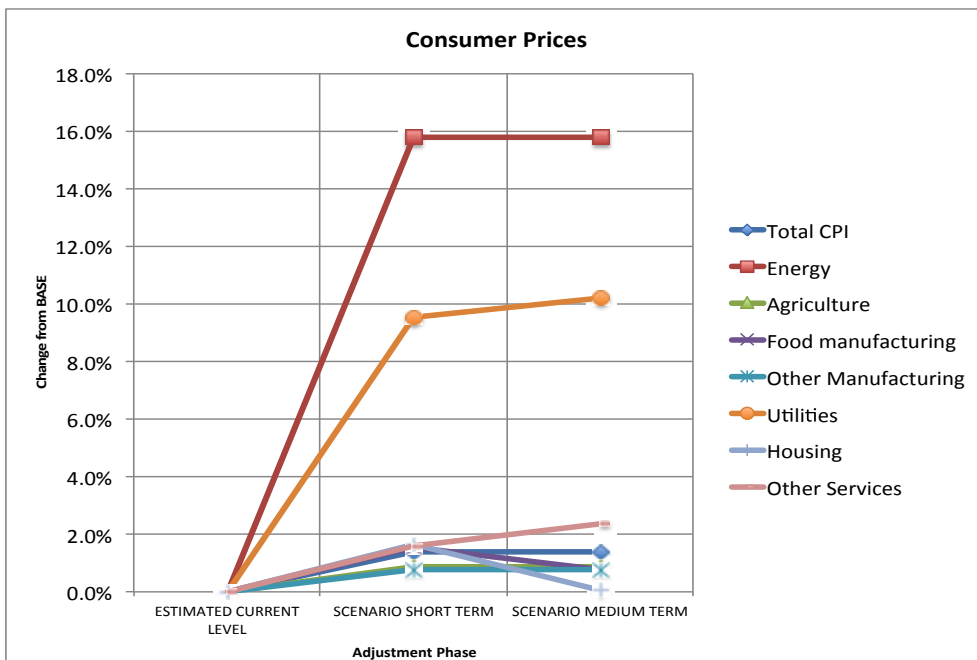
The short to medium term analysis employs a two-stage analysis of factor market adjustment. In the first stage the prices of labour are fixed and employment in all sectors is adjusted to the new commodity prices resulting from the energy price changes. Labour markets are then adjusted with wages flexible and full employment. Labour in contracting sectors is shifted to expanding sectors. The duration before the employment-adjusted stage is reached depends on the incentives and mobility of the labour force. In middle-income countries with limited social protection, the incentives for the labour force to find new employment are high and the adjustment can be done within the short to medium term.

⁶ It was estimated that offsetting transfers would initially amount to E£ 289.5 per person in the lowest quintile and E£ 357.2 for each person in the second lowest quintile. These transfers are subsequently reduced to E£ 136.0 and E£ 141.9 as employment normalizes.

However, mitigation measures, off-setting the income loss due to price changes through government transfers, may result in slower labour mobility response times.

The reduction in subsidies would lead to a short-term increase in overall energy prices of 16%, which would have immediate impacts on relative prices throughout the economy (Figure 3.) Our analysis suggests that the total CPI will increase by 1.4%, but prices for more energy intensive activities will increase more rapidly: notably transportation by 10% and water and sewage by 10%. Agriculture and food prices would increase by about 1%.

Figure 3: Consumer Prices



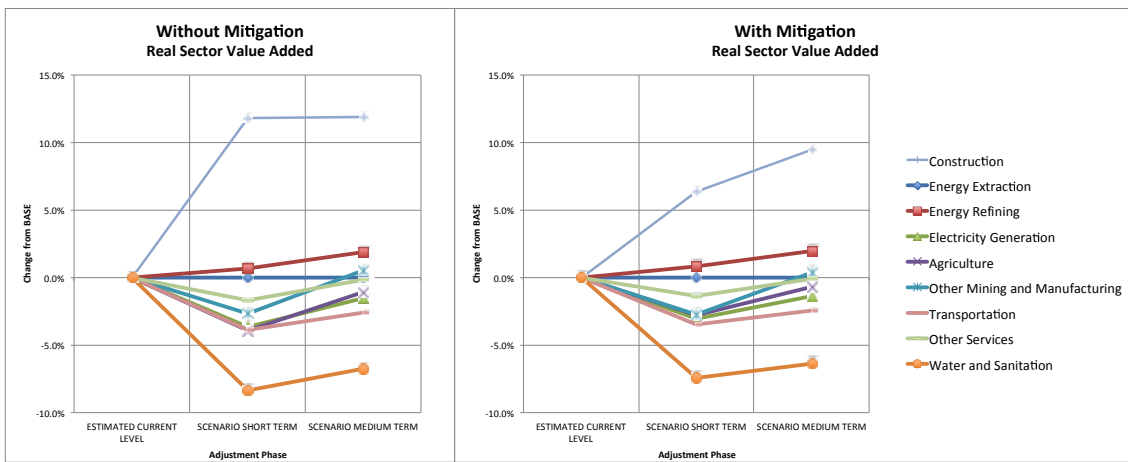
Source: Authors' Calculations

Note: The difference between scenarios is in the closure of the labour market. Short term scenarios have wages fixed at the initial level, with employment adjusting to a new equilibrium; the medium term scenarios have full employment and flexible wages.

The reduction in subsidies and changes in relative prices will lead to significant changes in activity across sectors (Figure 4.) The largest increase in value added would be in the construction sector, which would increase by about 10%. The biggest decline would be in the water and sanitation sector, by about 6%. Over time there would be a corresponding reallocation of investment across sectors. Broadly, there would be a shift away from the highly subsidized energy-intensive sectors, such as water and sanitation, transportation, energy refining and electricity generation, to other sectors.

The increase in construction value added is a result of the reduction in government deficit, which will release resources for capital formation activities. The increase in refining value added is due a shift in activity from lower-value added products for domestic market to higher value added exports. The household demands for high-energy sectors utilities (water, sanitation, and electricity) and for transportation is expected fall as a result of the higher energy prices being transferred to consumers as well as declines in real incomes. Less energy intensive sectors will see less of a decline in demand as prices are increasing more slowly and consumers will substitute expenditure away from energy intensive goods.

Figure 4: Changes in Sector Value Added



Source: Authors' calculations

4. The Impact of the Decline in Global Energy Prices

The July 2014 reforms come at a time when world prices for oil and oil products have declined substantially. The benchmark oil price at the time of the analysis had fallen by 50% since June 2014, (i.e., from \$115 bbl) and has at times fallen even lower. Whether this price has reached a stable equilibrium that will persist for some time is debatable.

Global demand for oil remains lower than it has been, mainly because of the still muted economic recovery in the developed economies. Prices have been kept lower for a number of reasons. Additional sources of supply, notably from the U.S., due largely to technological advances, making the U.S. one of the world's largest oil producers. The supply response from a number of major oil exporters remains uncertain, including leading OPEC supplier Saudi Arabia as well as Iraq, Iran and Libya. For Egypt's policy makers, there are sufficient

reasons to plausibly expect that oil prices will remain roughly where they stand today for the foreseeable future, but there always remains some chance that prices could return to earlier high levels.

The decline in oil and gas prices has also had an impact on Egypt's domestic energy sector. Egypt is the largest non-OPEC oil producer in Africa and the second largest dry natural gas producer.⁷ Oil production in 2013 averaged slightly less than 700,000 bbl/d, down from a peak of around 900,000 in the 1990s.⁸ Output of natural gas output increased until 2009, which partially offset declines in crude oil production. Egypt produced almost 2.0 Tcf of natural gas in 2013, of which almost 1.9 Tcf was domestically consumed. Much of the natural gas consumed in Egypt is used to fuel electric power plants. The government encourages households, businesses, and the industrial sector to consider natural gas as a substitute for petroleum products and coal.

Every percentage fall in international energy (oil) prices would result in lower budgetary costs for Egypt's energy subsidies. With the July 2014 reforms in place, lower energy prices reinforce the steps taken by the Egyptian government, in effect providing an ideal environment in which to reduce and eventually remove subsidies.

Our analysis examined the combined effects for Egypt of the July 2014 reforms and a sustained 50% reduction in energy prices as well as the impacts of each separately. The *combined* impact of these changes can be summarized as follows:⁹

- There would be a dramatic reduction (from 2013/14) of energy subsidies as a share of GDP from 9.2% to 2.2%;
- Government revenues would decline by 4.7% of GDP, mainly due to declines in oil and gas profit shares (3.9% of GDP);¹⁰
- Total government expenditures would decline by 7.2% of GDP;
- The government operational deficit would decline from 8.2% to 5.5% of GDP;

⁷ Source: U.S. Energy Information Agency (EIA), 2015.

⁸ Source: EIA, Egypt 2015.

⁹ There is no employment or real GDP impact – this is a static analysis with market clearing for all factors at the initial level (GDP impacts are shown in the dynamic analysis below).

¹⁰ Part of this decline (0.7% of GDP) is in the imputed revenue for the zero priced crude oil supplied to the refining sector, which is offset by declines in the imputed crude oil subsidies.

- Domestic consumer prices will increase by 3.1%;
- The impact of the oil price decline on domestic household incomes would be concentrated in the richest 20% of households, due to the sharp fall in capital rents derived from oil extraction; and
- The increased investment demand would result in higher real incomes and real consumption in all other households (i.e., the lower 80% of households by income).

It is worth noting that average domestic natural gas prices are currently above the international prices, and fuel oil prices have become above the cost recovery price, implying that these products are now effectively being taxed.

5. The Longer Term Economic Impact of the Reform Program

The analysis presented above is based on an assessment of the short-term impact of the July reforms. Of greater concern are the longer-term dynamic impacts that better reflect improved productivity and increased investment as a result of a more efficient allocation of resources and reduction in government deficits. The dynamic analysis presented here is for a ten-year period (2013/14 to 2024/25).¹¹

The model is run in a recursive dynamic mode where the previous period investment is added to the current period's capital stock, with adjustment for TFP and depreciation. It should be emphasized that the capital stocks used in the dynamic analysis is based on efficiency estimates. The capital stock in each sector is given by the operating surplus in each sector divided by an economy-wide capital return rate. However, in sectors not required to operate on a competitive market basis (i.e, electric power generation and refining) such estimates will substantially underestimate the capital stock and associated annual depreciation. The dynamic analysis presented here is thus only indicative.¹²

¹¹ In this analysis it is assumed that labor force growth is constant at 2%; total factor productivity growth is 3%; the capital depreciation rate is 4%; real government consumption growth is constant at 4%; nominal transfers grow at 9%; and the GDP price deflator is constant at 5%. However, in this model, as sector distortions are removed (or reduced), resources are re-allocated to more productive activities.

¹² In a subsequent paper we intend to update the model with new capital stock estimates for the power sector and include the gap between the commercial market capital return rate and the return rate in the power sector as an implicit subsidy to electricity generation.

The impact of the July 2014 price reform and the fall in international energy prices is lowered by a rise in other production cost inflation pressures. It is assumed that energy subsidies are converted to *ad valorem* rates to avoid subsidy rates increasing uncontrollably as a result of inflation. For the baseline case, subsidies remain constant at pre-reform levels. This is compared with three possible scenarios:

- The July 2014 price reforms are introduced, while international oil prices remain constant;
- The July reforms take place and international energy prices fall by 50%;
- The July reforms are introduced; international energy prices fall and energy subsidies are further reduced by an assumed 40% annually.

Real GDP

The Egyptian economy will grow at an annual rate of 4.2% under the base case assumptions, (see Table 3). When the July reforms are introduced, the annual growth rate increases to 4.4%. The 50% decline in international energy prices results in a GDP growth rate of 4.7%, or more than double the implied increase with the reforms alone (i.e., an increase from the base case of 0.5% as compared with 0.2% in the reform only case). In the final scenario, the remaining subsidies would be virtually eliminated through the annual 40% rate reduction (e.g., a 20% subsidy rate would be less than 2% after five years). In this case, the growth rate is sharply higher, 5.2%, a full percentage point higher than the base case.¹³ The growth impact is closely associated with the level of investment in each scenario.

¹³ Differences in GDP are the result of different levels of investment in the different scenarios. Employment is given by labour force growth and the full employment assumption (flexible wage rates).

Table 3: Dynamic Analysis, Real GDP

	Base	Reform	Reform & Prices	Reform, Prices & Phase out
Real GDP	Annual % Change 2013/14 - 2024/25			
GDP at Market Prices	4.2%	4.4%	4.7%	5.2%
Consumption	3.9%	4.0%	3.9%	4.1%
Investment	5.5%	6.6%	8.2%	10.2%
Exports	3.9%	4.1%	4.3%	5.0%
Imports	3.6%	3.9%	3.8%	4.5%

Source: Authors estimates

Investment, Consumption and Trade

In this framework, consumption growth remains relatively unchanged, but investment increases sharply under each scenario. It is 1.1% higher each year with the July reforms alone; 2.7% higher when international energy prices fall; and 4.7% higher when energy subsidies are phased out. The trade balance would gradually improve under all of the scenarios as exports grow at slightly higher rates than imports.

Public Finances

Government revenues, as a share of GDP, would be expected to fall over the ten-year period under each of the scenarios. The extent of the reduction is in line with the growth of GDP: the higher the growth rate, the lower will be the share of revenues by the end of the period (Table 4.) (Note that the analysis suggests that nominal revenues will increase.)

The budgetary cost of energy subsidies would, as expected, fall with the reductions in energy subsidy rates. Without the July 2014 reforms (i.e., under the base case), subsidies would actually increase as a share of GDP from 9.2% to 10.3%. With the July 2014 reforms alone, there would only a modest decline over ten years, to 8.5%, although this would be 1.8% of GDP less than the base case. The impact of falling international energy prices is striking, with subsidy costs falling by more than one-half the current base case level.

The budget deficit would also significantly decline under each of these scenarios. Other current expenditures would remain relatively constant, but transfers to households would be

reduced modestly over time. The change in budget deficit will release funds financing the investments as illustrated above.

Table 4: Government Accounts

		Base	Reform	Reform, Prices	Reform, Prices & Phase out
Billion E£	2013/14	2024/25	2024/25	2024/25	2024/25
	% GDP				
Revenue	25.7%	24.9%	24.5%	21.1%	20.0%
Energy Subsidies	9.2%	10.3%	8.5%	4.1%	-0.6%
Transfers to households	10.9%	7.3%	7.0%	6.5%	6.0%
Other Current Expenditure	13.8%	12.8%	12.8%	13.1%	12.9%
Government Deficit	-8.2%	-5.4%	-3.8%	-2.6%	1.8%

Source: Authors estimates

Balance of Payments

Reforming energy subsidies will have several effects on external balances: Imports and exports would both increase over time, although as noted, exports are expected to increase slightly more rapidly. This leads to a gradual fall in the trade deficit (Table 5). The capital account surplus will also decline in line with the trade deficit.

Table 5: Balance of Payments

		Base	Reform	Reform, Prices	Reform, Prices & Phase out
	2013/14	2024/25	2024/25	2024/25	2024/25
	% GDP				
Current Account Balance	-0.6%	-0.7%	-0.6%	-0.5%	-0.5%
Trade Balance	-1.8%	-1.5%	-1.5%	-1.4%	-1.3%
Transfers and remittances, net.	1.2%	0.9%	0.8%	0.8%	0.8%

Source: Authors estimates

Structure of Economic Activity

The broad distribution of economic activity does not change significantly under any of the scenarios analysed using this model. In general, the long-term structure of the economy will be determined primarily by income elasticities, the scope for international trade, and the distribution of income. Energy price reforms will tend to have limited structural effects. One exception would be the construction sector, which is very sensitive to the reform of energy subsidies and the resulting sharp increase in investment that would result from the introduction of reforms. With the complete phase-out of subsidies, construction's share of GDP would increase by nearly 50 percent by 2024/25. Energy refining would also be affected by the removal of subsidies, falling substantially under each of the three reform scenarios. The output shares of Water and Sanitation, Electricity Generation, and Transportation will decline as demand is being switched to other sectors due to lower relative prices.

Table 6: Economic Activity by Sector

		Base	Reform	Reform, Prices	Reform, Prices & Phase out
SECTORS	2013/14	2024/25	2024/25	2024/25	2024/25
	% GDP				
Energy Extraction	20.5%	18.2%	18.1%	18.1%	18.1%
Energy Refining	0.5%	0.4%	0%	0%	0%
Electricity Generation	0.9%	0.9%	0.8%	0.8%	0.7%
Agriculture	27.8%	28.2%	28.1%	27.8%	27.5%
Other Mining and Manufacturing	29.9%	30.9%	31.0%	31.0%	30.9%
Water and Sanitation	0.8%	0.8%	0.7%	0.7%	0.7%
Construction	6.9%	7.8%	8.3%	9.2%	10.2%
Transportation	12.7%	12.8%	12.6%	12.5%	12.0%
Other Services	69.1%	72.1%	71.4%	69.8%	68.3%

Source: Authors estimates

Table 7: Consumer Prices

	Base	Reform	Reform, Prices	Reform, Prices & Phase out
	Annual % Change 2013/14 - 2024/25			
Total CPI	5.7%	5.7%	6.2%	6.4%
Energy	5.4%	7.3%	7.2%	18.4%
Agriculture	5.9%	5.8%	6.3%	6.1%
Food manufacturing	5.8%	5.8%	6.3%	6.1%
Other Manufacturing	6.3%	6.1%	6.5%	6.7%
Water and Sanitation	4.8%	6.0%	6.3%	6.7%
Housing	5.5%	5.5%	5.7%	4.7%
Other Services	5.0%	5.2%	5.8%	6.2%

Source: Authors estimates

Growth and Structure of Employment

The structure and growth rates in employment from this analysis provide additional insights on the nature of the economic adjustments to be obtained with the reform of energy subsidies over time. It is worth noting that the energy sector employs only a relative small share of the labour force, 1.8% in the base year, and that with the reforms this would fall by only 0.6% of the labour force. The limitations on the input substitution in most of the other sectors constrain the employment impacts of these reforms.

The largest effects take place, as noted previously, in the construction sector, where the increases in employment would be substantial, with the share of total employment increasing by more than 50% under the more far-reaching reform efforts.

Table 7: Structure of Employment

	Base	Reform	Reform, Prices	Reform, Prices & Phase out
	2013/14	2024/25	2024/25	2024/25
% Total Employment				
Energy Sector	1.8%	1.5%	1.5%	1.2%
Agriculture	18.3%	18.2%	17.8%	17.1%
Other Mining and Manufacturing	13.0%	12.4%	12.7%	13.0%
Water and Sanitation	0.8%	0.8%	0.7%	0.7%
Construction	11.0%	11.9%	12.8%	14.6%
Transportation	7.3%	7.5%	7.0%	6.8%
Other Services	47.9%	47.7%	47.6%	44.7%

Source: Authors estimates

Table 8: Employment Growth

	Base	Reform	Reform, Prices	Reform, Prices & Phase out
	Annual % Change 2013/14 - 2024/25			
Energy Sector	0.3%	0.1%	-1.2%	-1.5%
Agriculture	1.8%	1.8%	1.7%	1.7%
Other Mining and Manufacturing	1.7%	1.9%	2.1%	2.3%
Water and Sanitation	1.5%	1.0%	1.0%	0.7%
Construction	2.7%	3.5%	4.9%	6.5%
Transportation	2.0%	1.7%	1.6%	0.8%
Other Services	2.1%	2.0%	1.9%	1.7%

Source: Authors estimates

6. Conclusions

The results presented here demonstrate the extent of the effects that the July 2014 reforms can be expected to have on the Egyptian economy in the short and the long-term. An advantage of undertaking this analysis with a dynamic CGE model is that it captures in a consistent way the direct and indirect effects of the current and possible future reforms, international energy price movements, and the introduction of offsetting transfers for the poor.

Large energy subsidies have introduced major distortions to the Egyptian economy that have led to significant misallocations of resources and reduced productivity, impeding economic

growth. The July 2014 reforms will reduce these subsidies by about one-quarter to one-third, depending on the basis of measurement. In any case, this amounts to only a significant first step towards improving long-term economic performance. That these reforms have come at a time when international oil prices are much reduced from where they have been in recent years is fortuitous for Egypt's policy makers. The prospect of possible reversals in oil prices makes it clear that the sustainability of these reforms will depend on ensuring that changes in international prices are quickly and fully reflected in domestic energy prices.

This analysis supports the provision of offsetting transfers to the poor in order to alleviate the impacts of reduced subsidies on real incomes. While such transfers would mitigate somewhat the economic benefits of the reforms, the impact is not likely to be large and this could further enhance the political support necessary for the implementation of the additional subsidy reforms that are warranted in the long run.

Annex: A Computable General Equilibrium Model for Egypt¹⁴

An economy-wide static Computable General Equilibrium (CGE) representation of the Egyptian Economy has been developed. The model has a disaggregated sector and energy product representation, as well as detailed household breakdown. This model is designed to analyse the economy-wide implications of specific policy measures in the energy subsidy reform focus areas both in isolation as well as any relevant combined effects. By applying the CGE approach, the analysis attempts to overcome over-simplification and/or erroneous conclusions that are found by looking at only partial equilibrium results or simple first round effects of the economic policy measures.

The economy-wide label implies that the model has a specific level of aggregation in all sectors of the Egyptian economy. The CGE specification implies that the model is a numerically specification of the demand and production relationships, the interrelationship between them, and is solved simultaneously for prices in all markets.

The model includes 56 productive sectors – 11 energy subsectors and 45 non-energy sectors - each producing a unique commodity that are traded domestically in competition with imported goods and/or exported internationally.

The Egyptian government revenue system has also been given specific consideration. The government collects direct taxes and shares of energy resource rents. The government also collects indirect taxes on final domestic consumption expenditures and imports. Finally, the government receives fees and fines from households and has additional non-tax revenue from ownership of equity in state utilities. Government subsidies are calculated either based on ad valorem subsidy rates or fixed prices. Government consumption expenditure and transfers to households are given exogenously.

The relationship with rest of the world is given by imports and exports of each commodity as well as any net-incomes from the external sector ownership of the Egyptian capital stock as well as exogenous transfers to households. An exchange rate equilibrates the external balance.

¹⁴ A detailed elaboration of the CGE model can be obtained from the authors by request.

The following elasticity estimates have been employed:

Elasticity Assumptions

	Factors	Energy	Other goods
Substitution/ Transformation			
Activities	0.4	0.5	0
Households		0.25	0.5
Armington			2.5
Household Income		1	1

The SAM cost, revenue, or expenditure shares and the definitions of Uzawa-Allen Substitution/Transformation Elasticities provide the Own and Cross Price Elasticities employed in the model.