



Economic and environmental impacts of electricity subsidy reform in Kuwait: A general equilibrium analysis



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ABSTRACT

This paper examined economic and environmental impacts of reducing electricity subsidy in Kuwait. A Social Accounting Matrix (SAM) was constructed together with energy consumption with CO₂ emission were compiled, and then calibrated with a computable general equilibrium (CGE) model. A simulation experiment was conducted by applying a 30% reduction of subsidy to the electricity sector. This policy shock was applied to the model in two scenarios. In scenario 1, the subsidy reduction was applied and results were compared with the baseline scenario given in the SAM. This yielded adverse economic effects on most endogenous variables but positive environmental benefits in terms of CO₂ emission reduction. Electricity tariff increased by three-fold from 2 to 6 fils (0.7 cents to 2 cents) per kWh. GDP fell by 0.5% and aggregate household welfare declined by 0.8%. In scenario 2, subsidy reduction was accompanied with cash transfers to compensate user losses. The subsidy deducted from the electricity sector was allocated to users according to their share in base year total expenditure on electricity. The results indicated that such transfers would reduce the adverse economic effects, CO₂ emissions fell by 0.5%. The GDP and household welfare effects were reversed, rising by 0.4% and 0.1% respectively.

1. Introduction

The dramatic fall in oil prices has prompted most Gulf Cooperation Council (GCC) member countries to start reforming their electricity and water tariffs. Krane and Hung (2016) described the energy price reforms in the Gulf region as the end of the “big oil giveaway”. The Kuwaiti government introduced a bill (Al-Harami, 2016) that was partially adopted by the parliament in late April 2016 (Izzak, 2016).

Kuwait's electricity tariff currently stands at 0.7 cents per kWh, one of the lowest in the world. For instance, Krane (2014, p. 1) reported tariffs (cents per kWh) for selected countries: Saudi Arabia (1.3), Iran (2.7), Russia (11), USA (11.8) and Norway (14.9). Kuwait's tariff was introduced in 1966 and retained at that level ever since. However, cost of power generation per kWh increased from 7 cents in 2000 to about 14 cents in 2010 in current prices (TED-KISR, 2014). Since Kuwaiti power plants use subsidized oil and gas, the rising cost of power generation is mostly explained by continuous capital investment.

Kuwait's lavish subsidy has served as a means of allocating welfare transfers to resident households and businesses. The government owns a vertically integrated monopoly and manages the entire supply chain from electricity generation to retail distributions (Wood and Alsayegh, 2014; Burney, 1993). Kuwait's electricity consumption per capita rose from 8000 kWh in 1985 to 17,000 kWh in 2005. In economic efficiency terms, measured in GDP generated per kWh consumed (Abbas and

Choudhury, 2013; Akinlo, 2009), Kuwait stands among the lowest in the world and the situation has gotten worse over the years. Kuwait's electricity is generated entirely depends on fossil fuels, which means the excessive consumption of power has serious adverse consequences on resource allocation as well as environment damages.

Kuwait's CO₂ emission per capita was 27.3 metric tons in 2013 (World Bank, 2017); about three times OECD and five times MENA (Middle East and North Africa region) averages. Kuwait's CO₂ per capita is the second highest in the Gulf region, after Qatar whose CO₂ emission per capita was 40 metric tons. However, there is a substantial difference between Kuwait and Qatar in that the latter uses a lion's share of its energy for intermediate consumption while the former allocates about two-third of energy for final consumption in the residential sector (NBK, 2015). Kuwait's CO₂ emissions come entirely from combustion of gas or oil. Electricity and heat production accounts for 70% of total fuel combustion; the corresponding figure for OECD average is 46%.

This study is timely in that it is conducted concurrently with the introduction of a bill to reform Kuwait's electricity subsidy. The objective of this paper is to quantify economic and environmental effects of reducing subsidy to the Kuwait electricity sector. A CGE model accounting for energy-economy interactions was formulated following a comparative static modelling approach. It was calibrated to a social accounting matrix (SAM) and related baseline data. A simulation experiment was conducted by applying a 30% reduction in electricity

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subsidy. Economy-wide impacts of this policy shock was analysed in two separate scenarios: subsidy reduction with or without compensating electricity users for losses incurred. Deviations of economic and environmental variables from the baseline scenario were compared and contrasted.

This study is the first application of a computable general equilibrium model to examine economy-wide impacts of electricity subsidy reform in Kuwait. It discloses effects of subsidy reductions that cannot be captured by partial equilibrium studies previously applied to Kuwait. For instance, [BuShehri and Wohlgenant \(2012\)](#) justified cash transfers as compensation only as a means to pre-empt political backlash to electricity subsidy reform. However, this study revealed economic rationales rooted in minimizing contractionary effects in some sectors or enhancing efficiency gains resulting from electricity subsidy in other sectors.

Previous studies on the Kuwait economy have not covered environmental effects but this study did not only quantify environmental effects but it also showed trade-offs between economic and environmental impacts of simulated electricity subsidy reduction. Finally, this study examines electricity subsidy reductions by taking into account unique features of labor market conditions prevailing in Kuwait. Accordingly, this study extends existing policy research by examining interactions between electricity subsidy reform and labor markets.

The remaining part of this paper is classified into four sections. Section two discusses background to the study and relevant literature. Section three provides detailed descriptions of the model and the baseline data. Section four presents and discusses simulation and sensitivity results. The final section focusses on conclusions and policy implications.

2. Background and literature review

2.1. Background

In most Gulf Cooperation Council (GCC) member countries, energy subsidies have given rise to unsustainable behaviour in electricity use. [Krane \(2013\)](#) described the situation as a ‘dichotomy between value and price’ to say that excessively low energy pricing induced ‘wanton consumption’ that is “low pricing encourages consumption at rates above those warranted by the opportunity cost of these fuels on global energy markets. Low prices have also distorted energy allocation preferences while undercutting upstream investment and efficiency incentives”.

In terms of economic efficiency, Kuwait does not only stand among the least efficient in the world but the situation has deteriorated over the years. In 1990 GDP/kWh was USD 1.4 but this fell to USD1.2 in 2005. This contrasts with experiences of other countries; for instance, the USA, which was doing already much better in 1990 (about USD 2.2/kWh) but reached about 2.7 in 2005 ([World Bank, 2017](#)). Kuwait's electricity consumption per capita doubled between 1985 and 2005, rising from about 8000 to 17,000 kWh.

The more rapid economic and demographic expansion in latest decade means Kuwait's electricity consumption per capita is slightly lower than the 2005 level, 15,240 in 2014; and sixth in the world, after Iceland (53,900 kWh), Norway (23,000 kWh), Bahrain (19,220 kWh), Qatar (16,700 kWh), and Canada (15,540 kWh) ([IEA, 2017](#); [IEA, 2015b](#)). It should be stressed that Kuwait's electricity is generated entirely by fossil fuels whereas the rest of non-GCC countries like Iceland, Norway and Canada largely rely on renewables.

The World Development Indicators Database ([World Bank, 2017](#)) shows that Kuwait's energy use per capita, measured in kg of oil equivalent, rose from 8083 in 1985 to 11,662 in 2005, a 44.3% increase over the two decades. The corresponding change for the USA during the same period was a 5.2% increase. In 1995, GDP per unit of energy use (at purchasing power parity USD per kg of oil equivalent) for Kuwait was almost twice that of USA (6.4 and 3.7 respectively). The

corresponding figures for 2012 were 7.2 and 7.5, i.e., USA showed substantial improvement and marginally moved ahead of Kuwait during the period, with 6% per annum while average annual improvement for Kuwait was 0.7%.

Kuwait's residential electricity consumption per capita in 2014 was 7332 kWh, moving Kuwait up to third, after Iceland and Norway. The share of final consumption in the residential sector ranged between 47% ([IEA, 2015b](#)) and 58% ([NBK, 2015](#)). No country in the list reported above allocates such a large proportion to residential sector. The ranking reported above get reversed with Kuwait moving to top and Iceland (only 23%) to the six positions, and the rest in between.

Kuwaiti authorities are committed to broader and far-reaching economic liberalization ([IMF, 2014](#)). There are two closely interrelated strategies: (a) diversifying the structure of the economy by reducing the dominance of the oil sector that currently accounts for 54% of GDP ([CSB, 2016a](#)) and encouraging growth of the non-oil sectors; and (b) promoting private sector development and reducing the dominance of the public sector that currently employs 74% of total Kuwaiti labor force ([CSB, 2016b](#)). Liberalization of public utilities are among prime target in achieving these goals.

Additionally, there is regional policy environment related to the GCC electricity grid interconnections ([Tabors, 2009](#)). The new system encourages countries to engage in trading electricity with each other based on their comparative marginal costs ([Al-Asaad, 2009](#)). This requires marginal costs of production and distribution in each country to be competitive relative its neighbors. Kuwait is already at a disadvantageous position since its marginal cost is higher than most other GCC member countries. For instance, Qatar's marginal cost of electricity production at peak is less than half of that of Kuwait, \$88/MWh and \$188/MWh respectively ([Tabors, 2009](#)). These differences are largely explained by types of turbines or types of fuel used to fire electricity generating plants – mostly natural gas in Qatar and heavy oil in Kuwait.

2.2. Review of previous studies

There is a growing awareness among policy-makers and researchers that the existing policy is not sustainable ([Gelan, 2014a, 2014b](#); [Alotaibi, 2011](#); [BuShehri and Wohlgenant, 2012](#); [Darwish et al., 2008](#); [Darwish and Darwish, 2008](#)). However, there have been very few analytical studies providing insights into options for the optimal mix of policy instruments.

There are notable differences among GCC member countries with regard to each country's progress towards implementing electricity subsidy reforms ([Fattouh and El-Katiri, 2013](#); [Wang et al., 2016](#)). [Dyllick-Brenzinger and Finger \(2013\)](#) observed that “Kuwait is located at the least reform-oriented or otherwise conservative end of the spectrum.” The literature on Kuwait's electricity sector reform is mostly ex-ante analysis of what is expected to happen when current subsidy is reduced. There are marked differences in the scope and method of previous studies on Kuwait's energy sector. A partial equilibrium analysis ([BuShehri and Wohlgenant, 2012](#)) and an econometric analysis ([Burney and Al-Matrouk, 1996](#)) are the two pieces of analytical studies that are most relevant to the current study.

[Burney and Al-Matrouk \(1996\)](#) has examined factor substitution possibilities in Kuwait electricity generation. Their findings implied that “using factor prices, particularly fuel prices, as instruments will not only help with energy conservation, but will also induce more demand for capital.” (p. 78). However, fuel or factor price reforms have wider and economy-wide ramifications and hence they may not be suitable to directly target removals of sector specific distortions such as low electricity tariffs induced by government interventions such as production subsidies. It is appropriate to find alternatives ways of putting the price policy into practice. The most straightforward way to cause changes in electricity tariff is to change the rate of subsidy. Hence, the present study followed the latter approach, subsidy reduction as an effective means of raising electricity tariff.

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