Chapter 10

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CHAPTER 10

Study on the Impact of Electricity Tariff Increase on the National Economy of Vietnam

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The electricity price in Vietnam in 2011 was around 6 US ¢/kWh which is lower than the Long Run Marginal Cost (LRMC) of 9.5 US ¢/kWh. This low price discourages energy productivity enhancement and affects energy supply security. Thus, the Government of Vietnam plans to increase the electricity tariff. This study examines the impacts of increasing electricity tariff to the LRMC on prices of consumer goods and services and the likely distribution impacts by household income quintiles using a static Input-Output approach. The study found that such an increase would drive up the prices of all other products. The price impact, however, is not large. The distribution impact by household income quintiles is also not large. Although the impact is not large, it would be socially difficult to implement this increase at once, particularly given that Vietnam is facing high inflation rates. A roadmap for electricity tariff increase is thus discussed.

1. Background

Vietnam's high economic growth rate has led to increasing demand for electricity. Between 2001 and 2010, electricity production (including imported electricity) increased from 31.13 billion kWh to 100 billion kWh; electricity sales from 25.8 billion kWh to 86.8 billion kWh and installed capacity from 7,872 MW to 21,542 MW, reaching an average annual growth rate of 13.8%, 14.4% and 12%, respectively. Generation mix in 2010 was gas fired power plants 41%, hydro power plants 37.7%, coal fired power plants 11% and the rest are oil, renewables and import from China. As an emerging economy, electricity demand is expected to keep growing significantly in the forthcoming period, 2010–2030. The Power Development Plan No. 7 forecasted that electricity demand would increase from 100 billion kWh in 2010 to 695 billion kWh by 2030, at an average annual growth rate of 10% per year (PM, 2011b). Vietnam is expected to become a net energy importer by around 2015.

Such rapid development raises a number of questions for the Government of Vietnam, including (i) how to secure funds to finance such an aggressive power source development, and then (ii) how to manage the power sector effectively and efficiently. Currently, the power sector of Vietnam is dominated by the Electricity of Vietnam (EVN), a government-owned utility. EVN has a majority in generation capacity (around 65% in 2010), and a monopoly role in transmission and sales of electricity. Electricity retail tariff in Vietnam is governed by the Government, and the Government of Vietnam maintains uniform national electricity tariff across the country which is highly subsidized. The weighted average retail electricity tariff in Vietnam in 2011 was only 6.0 US¢/kWh while the Long Run Marginal Cost (LRMC) was 9.5 US¢/kWh. The subsidy amount in 2010 was estimated at 2.69 billion USD, equivalent to 2.83% of GDP in the same year (IEA, 2011). EVN's revenue in 2010 was around USD 4.5 billion while the required investment capital is estimated at between USD 6-7 billion per year over 2011-2030.

To address these challenges the Government of Vietnam plans to restructure the power sector. The roadmap which has been approved by the Prime Minister specifies that the power market in Vietnam will be established through three sequential developments: *competitive generation power market, competitive wholesale power market and competitive retail power market.* Phase I starts in 2009, phase II in 2017 and phase III in 2024 (PM, 2006).

To do this, however, the electricity retail tariff to users, and subsequently the purchasing price for power from power producers, must first be increased. This is because the weighted average retail electricity tariff in Vietnam was generally lower than that of most countries (for example, the electricity price in Thailand in 2011 was 10.6 US¢/kWh) (ADB, 2012b) and, therefore, not attractive for local and foreign enterprises to invest in new generating capacity in Vietnam. This situation is also unfavorable for Vietnam with regard to the promoted plan of regional power interconnection grid (for example, the electricity imported from China is currently paid at a higher level than the purchasing price to power producers).

This problem has been recognized by the Government of Vietnam. As a response, the Government of Vietnam plans to increase the electricity tariff to reflect the production cost to improve energy supply security and to improve energy productivity (PM, 2009 and PM, 2011a).

This action will definitely have impacts on other sectors, on macroeconomic indicators and social welfare. In this study, we examine two broad questions: First, what would be the impacts of rising electricity tariff on prices of other sectors of the economy? In connection with this question, electricity intensity of various sectors will be first explored. Second, what are the likely distributional impacts induced by this price rise?

To answer the above questions this paper presents the methodology used to examine the impacts of electricity price increase on other sectors in Section 2. Section 3 discusses the results and Section 4 considers some policy recommendations.

2. Methodology and Data Preparation

Because electricity is used as inputs to produce most of the goods and services, a higher electricity price can affect the prices of other sectors of an economy both directly and indirectly.

The I–O model describes the interdependence of all sectors in the production and consumption of products. It shows the input requirement for a sector and at the same time specifies how that sector distributes its production output to other sectors. In this regard, the I–O model is able to analyze the relationships among sectors, evaluate the impacts from one sector to other sectors, and can thus be used to quantify the effects from the electricity sector.

The I–O model was first proposed by Leontief in 1936. Since then it has been applied to various areas. It has also been widely applied in energy-related contexts including electricity. Using the I–O model, Pfaffenberger, *et al.* (2003) examined the impacts from the development of renewable energy technologies such as wind turbine and solar photovoltaic on the economy of Germany in terms of creating job. Tiwari (2000) used I-O modelling to estimate energy intensities of different sectors in India. Similarly, Pachauri & Spreng (2006) also used the I–O model to determine the indirect energy requirements of Indian households. Hadley, *et al*. (2001) examined the impacts from the restructuring of the power sector on Oklahoma in the USA.

The I–O model has been introduced at some universities in Vietnam since the mid-1960s (Dong, *et al*. 2006). However, it was not until 1989 that the first national I–O table of 54 sectors was made. To date, four national I–O tables have been created. The latest table consists of 138 sectors for 2007 and was released in 2010. There have been several studies applying these I–O tables. For example, Bo (2002) applied the I–O table to examine the role of the construction sector in the national economy. Tuyet & Ishihara (2006) used the I–O tables of 1996 and 2000 to examine the changes in energy intensities of different sectors between 1996 and 2000. Recently, a research group from the National University of Economics has used the I-O table of 2005 to examine the impacts of rising petroleum products on the economy (Thanh, *et al*. 2008). Khanh (2008) examined the impact of a rise in

electricity tariff on prices of consumer goods and services in Vietnam. There has, however, been no study consisting of a complete and updated examination of the sectoral impacts of electricity prices in the Vietnamese economy.

With salient features in impact investigation and related applications as described above, in this research, the I-O model is chosen to examine the impacts from electricity tariff increase on the prices of other sectors in Vietnam. For this purpose, the following subsection will focus on the description of the I-O model and its adaptability to this specified task.

2.1. The General Framework of I-O Model

The I-Omodel is a set of linear equations, which represent the relationships among sectors of an economy over a stated period of time, say, a year. The I-O model for an economy consisting of n sectors can be expressed as

$$X_i = \sum_{j=1}^{n} X_{ij} + F_i = \sum_{j=1}^{n} a_{ij} X_j + F_i \qquad (1)$$

or

$$X_j = \sum_{i=1}^{n} X_{ij} + V_j = \sum_{i=1}^{n} r_{ij} X_i + V_j \qquad (2)$$

where X_i is the total gross output of sector i ($i=1,.....,n$); a_{ij}, defined as the delivery from sector i to j (X_{ij}) per unit of sector j's output (X_j) are known as direct input or technical coefficients; r_{ij} are direct output coefficients, obtained by dividing the purchase by sector i from sector j by X_i total gross input of sector i; F_i is final demand for sector i; and V_j is the value added in sector j.

Equation (1) shows that the total production of any sector is equal to the sector's products used by all sectors in the economy plus the amount demanded for final use by consumer, exports, investment and government minus imports. Equation (2) indicates that the total production of any sector is equal to the total purchase made by the sector from all sectors in the economy plus value added (i.e., wages, salaries, profit, taxes, etc.) in this sector.

2.2. Deriving electricity intensity

Equation (1) can be expressed in matrix form as

$$X = AX + F \tag{3}$$

or

$$X = (I - A)^{-1} F \tag{4}$$

Where X represents vector of gross output, $(I-A)^{-1}$ is the Leontief's inverse matrix, I is the identity matrix, A is the coefficient matrix, and F is the vector of net final demand. The elements of inverse matrix represent the total direct and indirect requirement by sector per unit of final demand. Thus, Eq. (4) can be used to compute the electricity requirement as a result of a given change in final demand F of each sector.

2.3. Sectoral Price Effects

Equation (2) can be rewritten in terms of prices as follows:

$$P_j = \sum_{i=1}^{n} r_{ij} P_i + V_j \tag{5}$$

The equation states that the price which each productive sector of the economy receives per unit of its output must equal the total outlays incurred in the course of its production. These outlays comprise not only payments for inputs purchased from the same and from the other industries, but also the value added (i.e., wages, salaries, profit, taxes, etc.), which essentially represent payments made to exogenous sectors. Thus,

$$P = (I - R)^{-1} V \tag{6}$$

Equation (6) is the Leontief Price Model and can be used to assess the impact on prices throughout the economy of an increase in value-added cost in one or more sectors (Miller & Blair, 1985). However, Equation (6) cannot exactly assess the impact from a change in the price change of one sector (the electricity sector for example) on the other sector since that sector is part of the I-O matrix. To address this, that sector must be treated externally and is included in the value added.

Adding superscript * to the new matrices and superscript E to the vector related to the examined sector gives: $P^* = (I - R^*)^{-1}\left(V^* + R^E P^E\right)$. The assumption ΔV*=0 (no change in the value added) yields:

$$\Delta P^* = (I - R^*)^{-1} R^E \Delta P^E \qquad (7)$$

Eq. (7) can be used to investigate the impacts of a change in the electricity price on the prices of other sectors. It is worth noting that Eq. (7) provides us with the sum of both direct and indirect impacts of a rise in P^E on P*. The direct effect shows the intermediate price response of a sector, whereas the total effect determines the price changes after taking into account the sectoral inter-dependencies.

The overall impact of ΔP* on the Consumer Price Index (CPI) is then estimated by calculating weighted average of the sectoral price changes, based on their shares in total private consumption.

Given the estimated sectoral prices rises, the distribution impacts by household income quintiles can then be examined by matching sectoral price changes with household spending pattern described in household expenditure survey. The General Statistics Office has been conducting a Household Expenditure Survey every two years since 2002. The expenditure on different consumer goods and services by the percentage of total spending by household income quintile is gathered.

2.4. Data Preparation and Assumptions

To simulate the impact of an increase in electricity tariff on the prices of other sectors in Vietnam, we use the I-O table for 2007. This I-O table consists of 138 sectors and is the latest available (GSO, 2010). To facilitate the calculation, these 138 sectors are aggregated into 50 sectors as shown in Table 1. The I-O system is based on the following assumptions: (i) fixed input/output ratios, and (ii) fixed input ratio, due to the linearity of the model, and (iii) exogeneity of primary inputs and final demand components.

For the modeling purpose, this study assumes an increase by 3.5 US¢/kWh which is exactly the difference between the present average tariff and the LRMC or a 58.3% increase over the present average tariff.

For exploration of the distributional consequences of the simulated price changes, the household expenditure survey for 2006 is used (GSO, 2008). As this survey result is one year older than the I-O table used in this study, it is assumed that the expenditure pattern by household quintile in 2007 was similar to that of 2006.

3. Empirical Results

Table 1 shows the electricity requirement as input, both direct and indirect for a unit increase in the activity of various sectors which can be regarded as electricity intensity.

Excluding electricity sector, water processing is the most electricity intensive sector (0.224). This is not surprising as electricity is the main direct intermediate input for its production (0.181). Other sectors that also have high electricity intensities include gas (0.148), paper & paper products (0.097), chemicals & chemical products (0.095). There are 22 sectors with electricity intensities of more than 0.05. The least electricity intensive sector is coke coal (0.011). The weighted average electricity intensity based on the sectoral shares in total gross output is estimated at 0.074, meaning to generate USD 1, Vietnam would need on average USD 0.074 worth of electricity input. Excluding electricity from the list as it could distort the result, the average would become 0.045.

Table 2 shows impacts from a rise of 58.3 % in the electricity tariff (from 6.0 to 9.5 US¢/kWh) on the prices of other sectors both directly and indirectly. Six sectors experience a direct price of more than 1.5 % in their prices: Water processing (10.56%); Gas (6.96%); Sport, entertainment (3.41%); Hotel and restaurants (2.28%); Paper and paper products (1.96%); Chemical & Chemical products (1.96%). These sectors are thus relatively more reliant on electricity and therefore an increase in electricity immediately impacts on their production costs.

Table 1: Direct and Total Electricity Use of Various Sectors for $1 Increase in Final demand in 2007

Nr.	Sector	Electricity intensity		Ratio
		Direct	Total	
1	Crops	0.006	0.033	0.18
2	Livestock and poultry	0.007	0.043	0.16
3	Agricultural services	0.021	0.062	0.34
4	Forestry	0.003	0.019	0.17
5	Fish & other marine products	0.008	0.045	0.17
6	Metallic ores & non-metallic minerals	0.010	0.022	0.43
7	Processed, preserved meat and by-products	0.006	0.046	0.12
8	Processed, preserved fishery and by-products	0.012	0.059	0.21
9	Processed preserved vegetables and fruit	0.010	0.050	0.21
10	Milk and by-milk	0.007	0.044	0.16
11	Rice and Flour (all kinds)	0.011	0.049	0.23
12	Cacao, chocolate and candy, cake products from flour	0.018	0.058	0.31
13	Café	0.009	0.030	0.31
14	Animal feed	0.007	0.048	0.15
15	Beverages, alcoholic & non-alcoholic	0.015	0.050	0.30
16	Cigarettes	0.006	0.046	0.12
17	Textiles	0.016	0.079	0.21
18	Leather & leather products	0.022	0.067	0.33
19	Wood products	0.016	0.047	0.35
20	Paper & paper products; printed matters	0.034	0.097	0.35
21	Coke coal and other by-product cokes	0.002	0.011	0.15
22	Gasoline, lubricants	0.005	0.035	0.13
23	Chemicals & chemical products	0.034	0.095	0.36
24	Medicines	0.014	0.052	0.27
25	Rubber products	0.002	0.020	0.09
26	Plastic products	0.007	0.050	0.14
27	Non-metallic mineral products	0.024	0.055	0.43
28	Cements	0.012	0.041	0.28
29	Basic metals & fabricated metal products	0.011	0.058	0.19
30	Electronics apparatus	0.008	0.053	0.16
31	Machinery, electric equipment	0.006	0.026	0.23
32	general-purpose machinery	0.025	0.065	0.38
33	Cars and other transport means	0.013	0.058	0.22
34	Motor vehicles, motor bikes	0.014	0.056	0.25
35	Bed, cabinet, tables, chairs	0.012	0.041	0.30
36	Other products	0.014	0.045	0.30
37	Electricity	0.138	1.169	0.12
38	Gas	0.119	0.148	0.81
39	Water processing	0.181	0.224	0.81
40	Management and waste water handle, waste	0.024	0.043	0.55
41	Construction	0.005	0.038	0.14
42	Transport	0.005	0.026	0.20
43	Post & telecommunication services	0.016	0.043	0.38
44	Hotel & restaurant services	0.039	0.059	0.66
45	Finance	0.008	0.023	0.35
46	Tourism	0.008	0.026	0.32
47	Education	0.020	0.038	0.52
48	Healthcare	0.016	0.046	0.35
49	Sports ; entertainment	0.058	0.086	0.68
50	Other service	0.019	0.036	0.52

Table 2: Effects from a 58.3% Rise in Electricity Tariff to Prices of Other Sectors

Nr.	Sector	Effects of 58.3% rise in electricity tariff on prices of other sectors	
		Direct impact (%)	Total impact (%)
1	Crops	0.34	1.62
2	Livestock and poultry	0.40	2.14
3	Agricultural services	1.23	3.10
4	Forestry	0.19	0.97
5	Fish & other marine products	0.44	2.23
6	Metallic ores & non-metallic minerals	0.56	1.11
7	Processed, preserved meat and by-products	0.32	2.31
8	Processed, preserved fishery and by-products	0.71	2.94
9	Processed, preserved vegetables and fruit	0.61	2.50
10	Milk and by-milk	0.41	2.18
11	Rice and Flour (all kinds)	0.66	2.46
12	Cacao, chocolate and candy, cake products from flour	1.06	2.91
13	Cafe	0.54	1.51
14	Animal feed	0.42	2.41
15	Beverages, alcoholic & non-alcoholic	0.87	2.52
16	Cigarettes	0.32	2.30
17	Textiles	0.95	3.94
18	Leather & leather products	1.28	3.33
19	Wood products	0.94	2.32
20	Paper & paper products; printed matters	1.96	4.82
21	Coke coal and other by-product cokes	0.10	0.57
22	Gasoline, lubricants	0.28	1.75
23	Chemicals & chemical products	1.96	4.73
24	Medicines	0.83	2.59
25	Rubber products	0.10	0.99
26	Plastic products	0.41	2.48
27	Non-metallic mineral products	1.39	2.76
28	Cements	0.68	2.05
29	Basic metals & fabricated metal products	0.63	2.91
30	Electronics apparatus	0.48	2.63
31	Machinery, electric equipment	0.35	1.30
32	general-purpose machinery	1.43	3.25
33	Cars and other transport means	0.74	2.91
34	Motor vehicles, motor bikes	0.82	2.79
35	Bed, cabinet, tables, chairs	0.73	2.06
36	Other products	0.79	2.23
37	Electricity	-	58.3
38	Gas	6.96	7.36
39	Water processing	10.56	11.15
40	Management and waste water handle, waste	1.39	2.15
41	Construction	0.31	1.88
42	Transport	0.31	1.31
43	Post & telecommunication services	0.96	2.14
44	Hotel & restaurant services	2.28	2.95
45	Finance	0.47	1.16
46	Tourism	0.49	1.32
47	Education	1.17	1.90
48	Healthcare	0.94	2.32
49	Sports ; entertainment	3.41	4.30
50	Other service	1.10	1.82

Further, the indirect effect (total effect minus direct effect) exceeds 1.5 % for 24 sectors and 2% for the following 9 sectors: Textile (2.99%); Paper & paper products (2.86%); Chemicals & chemical products (2.77%); Basic metals & fabricated metal products (2.28%); Processed preserved fishery and by-products (2.23%); Cars and other transport means (2.17%); Electronics apparatus (2.15 %); Plastic products (2.07 %); Leather & leather products (2.05%). The price increase in these sectors is mainly due to inter-dependencies amongst industries. These sectors might not use electricity significantly as an intermediate input, but they need to buy intermediate inputs from those sectors in which electricity constitutes a higher proportion of total intermediate inputs cost. For example, the plastic product purchases only a negligible percentage of its intermediate input from the electricity sector (with direct coefficient of 0.0071).

The total impacts in Table 2 indicate that the electricity price rise would increase in the following 5 sectors more than 4 %: Water processing (11.15%); Gas (7.36%); Paper & paper products (4.82%), Chemical & chemical products (4.73 per cent) and Entertainment & Sport (4.3%). The impact on a sector is comparable to its electricity intensity shown in Table 1. From this simulation, it would be possible to say that the impact on the iron and steel sector, if electricity price rises is not as much as is expected (overall only 2.9% in this rise scenario), the sector ranks 13th in the list of 50 sectors.

These increases in prices would lead to an increase in the CPI (Consumer Price Index) of 4.2%, based on their shares in total private consumption. These increases in prices could relate to household expenditure by quintiles to assess distribution impacts. Unfortunately, like most countries, the I-O tables of Vietnam do not provide such information so we have to employ another method.

The General Statistic Office has been conducting Household Expenditure Surveys every two years since 2002, and this data can be used to assess distribution impacts by household income quintiles. In this study, we use the 2006 survey which is the closest to the year of the I-O table used in this study - 2007. Table 3 summarizes the expenditure on different consumer goods and services by the percentage of total spending by household income quintiles.

A relative measure is needed to identify which expenditure items are relatively more important for the "poor" (first quintile) and for the "rich" (fifth quintile), respectively. In Table 3, the approximate relative measure is the quotient of the percentage share of the first quintile to the percentage share of the fifth quintile. If it is more than one, we say that the poor spend a higher proportion of their total expenditure on that item than the rich, and vice versa.

As we can see in Table 3, the first five items have relative measure more than one which thus indicates the poor spend a higher portion of their total expenditure on those items than the rich. These are all basic needs for life sustenance: Food; Fuel; Foodstuff; Healthcare; Garment. To be able to see the impacts from the electricity price increase on these items by income quintile, items in Table 2 have been regrouped to match those in the household expenditure survey.

Table 3: Share of Household Expenditure on Different Goods and Services by Household Income Quintile Group (Per cent)

Expenditure item	Income quintile					Relative measure	Rank
	Group 1	Group 2	Group 3	Group 4	Group 5		
Food	25.22	18.80	14.35	10.23	6.19	4.08	1
Fuel	4.45	3.46	3.13	2.99	2.35	1.90	2
Foodstuff	30.17	31.21	30.16	28.35	25.28	1.19	3
Healthcare	6.82	6.82	6.84	6.55	5.84	1.17	4
Garment, hat, shoes, sandals	4.95	4.79	4.75	4.46	4.27	1.16	5
Drinking and smoking	2.87	2.94	3.02	3.10	3.24	0.89	6
Education	5.39	6.54	6.68	6.93	6.17	0.87	7
Furniture	6.82	7.38	8.36	9.04	10.78	0.63	8
Others	2.18	2.76	3.13	3.31	3.51	0.62	9
Electricity	2.07	2.39	2.52	2.70	3.53	0.59	10
Travel & telecommunic.	5.84	7.86	9.34	11.86	15.59	0.37	11
Housing, water, sanitation	0.55	0.59	0.90	1.48	1.59	0.35	12
Outdoor meals	2.47	4.23	6.42	7.95	8.79	0.28	13
Culture, sport, recreation	0.20	0.24	0.40	1.03	2.89	0.07	14
Total	100.00	100.00	100.00	100.00	100.00		

Table 4 shows that a rise in electricity tariff increases the cost of producing these items not more than the other items, except Fuel (5.39%), but since their shares in household expenditure are quite high, for example Foodstuff (30.17%) and Food (25.22%) for the first quintile, the overall impacts for these commodity groups are quite high.

In terms of the impact on the electricity prices themselves, the lower quintile suffers the less loss. This is because their payment for electricity represents a smaller share in their annual expenditure than the "rich". This result is influenced by the fact

that a number of households in rural areas are still without access to electricity. They are poor and have relatively lower electrification rates than better income households. Unfortunately, the survey results could not provide this detailed information.

Table 4: Impact for Each Commodity Group by Income Quintile (Per cent Increase in Expenditure)

Expenditure item	Total price increase	Percent increase in expenditure by income quintile				
		Group 1	Group 2	Group 3	Group 4	Group 5
Food	1.82	0.46	0.34	0.26	0.19	0.11
Fuel	5.39	0.24	0.19	0.17	0.16	0.13
Foodstuff	2.73	0.82	0.85	0.82	0.77	0.69
Healthcare	2.23	0.15	0.15	0.15	0.15	0.13
Garment, hat, shoes, sandals	3.36	0.17	0.16	0.16	0.15	0.14
Drinking and smoking	2.40	0.07	0.07	0.07	0.07	0.08
Education	1.95	0.10	0.13	0.13	0.14	0.12
Furniture	2.07	0.14	0.15	0.17	0.19	0.22
Others	2.19	0.05	0.06	0.07	0.07	0.08
Electricity	58.3	1.21	1.39	1.47	1.57	2.06
Travel and telecommunication	2.47	0.14	0.19	0.23	0.29	0.38
Housing, water, sanitation	2.11	0.01	0.01	0.02	0.03	0.03
Outdoor meals	3.02	0.07	0.13	0.19	0.24	0.27
Culture, sport, recreation	3.39	0.01	0.01	0.01	0.04	0.10
Total		3.65	3.84	3.94	4.06	4.54

4. Policy Implications

The results from above show that the impacts are not large and could be, in reality, even smaller as sectors could cut the benefit or rearrange their activities in favor of other factors of production including labor and capital, but it would be socially difficult to implement this increase at once, particularly given the high inflation rate the country is facing. The inflation rates in 2008, 2009, and 2010 were 23.0%, 6.9%, and 9.2%, respectively (ADB, 2012a). Also, the present slowdown of the market, lack of access to credit by producers, and increasing labor cost do not favor this. It is thus proposed that the increase in electricity tariff be gradual and separate by sectors. The results in Table 2 might help policy makers design such a policy. To assist policy makers developing roadmaps for introducing electricity tariff increase, the CPI increase as a function of electricity increase level has been performed (Table 5).

Table 5: CPI Increase as a Function of Electricity Price Increase (in Percentage)

Percentage increase in electricity tariff	Percentage increase of CPI
10	0.72
20	1.44
30	2.16

In parallel with measures to increase tariff, the power sector should consider improving efficiency performance as this would relieve the pressure of investment and tariff increase. The improvements would accrue to both demand and supply sides. On the supply side there is improvement in efficiency of generation and distribution. For example, coal fired power plants currently representing 11% installed capacity and about 15% of power generation output of the total system have efficiencies of between 28-32% which are about 10% lower than the world average levels. Transmission and distribution losses at the present are estimated at 10%. On the demand side there is the improvement on energy productivity. The electricity intensity in Vietnam is higher than most countries, including those with the same level of GDP per capita indicating high electricity saving potentials and Table 1 could help identify the specific sectors.

Finally, the large difference of electricity intensity of sectors might suggest a restructuring of the economy in the long run for the sustainable development of the country. The idea is electricity intensive sectors that contribute less to the GDP might be reorganized and tertiary industry might be encouraged.

However, it is important to note some shortcomings of I-O analysis. The I-O table used in this analysis is for the year 2007. The present economic structure might be different from that of 2007. These results are also limited by the assumptions of the I-O model: (i) fixed input/output ratio, and (ii) fixed input ratio. Likewise, the household expenditure survey results used in this study were for the year 2006.

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