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The Effect of Raising Electricity Price on Welfare of the Household Sector in Rural Areas of Guilan Province, Iran

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Abstract

Present study investigates the effect of soaring residential electricity price on the welfare of rural individuals in Guilan Province by Almost Ideal Demand System (AIDS) in which the elasticity's and welfare variations were calculated by Compensation Variations (CV) and Equivalent Variations (EV) for the time period of 1991-2012. It was shown that the absolute value of income and price elasticity of electricity was less than one unit. Low price elasticity of the demand shows the slight impact of price variations on the demand for electricity in the studied period, on the one hand, and the lack of an appropriate substitute for electricity in residential sector, on the other hand. The calculation of welfare variations and its comparison with the share of electricity in the paid subsidy shows that with 50% and 100% increase in residential electricity price, the cash paid to the households is less that the amount acquired. Accordingly, it can be argued that the direct effect of residential electricity price modification (increase) has not been compensated. In fact, the welfare loss of the households, due to more expensive electricity, is more than the acquired welfare. Yet, in a gradual increase scenario, the calculated CV is less than the payments to the families, and hence it is the only price policy that does not impose a loss on families and improves their welfare.

Keywords:
Almost Ideal Demand System; deadweight loss (welfare loss); residential electricity; rural households of Guilan Province

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INTRODUCTION

One important issue in modern world is to balance supply and demand for energy carriers. Nowadays, owing to its relationship with other sectors and economical institutions electricity plays an important role in economical decision-making process and the attempts to achieve development goals (Ahmadi et al., 2009). On the other hand, given the fact that it is one of the most important energy carriers consumed by residential sector and its production is highly capital-consuming and complex for which non-renewable energy carries are mostly used, electricity is regarded to be of crucial importance. The problem becomes even more acute by the limitations of non-renewable energy carriers on the one hand and the growth of users and population (which is closely related to the demand for electricity) on the other hand.

In Iran, since the price of electricity which is highly subsidized by the government is unreal, per capita demand for it is very high (2900 kwh the average household electricity consumption) resulting in low economic growth, damaging economical infrastructures and reducing the competitiveness of Iranian products in foreign, and even, domestic marketplace (Mirzamohammadi & Karimi, 2011). Iranian state has tried a lot to modify energy pricing mechanism and its marketability. But, it is still far different from international pricing mechanisms, for which the main reason is the governmental subsidization for energy consumption and price started since 1979. So, energy prices in Iran are generally less than international standards (the average global price of electricity is 800 until 1000 IRR). This lower energy prices cannot fully reflect the relationship between energy consumption and demand. The distorted energy price creates serious challenges to energy consumption and economic welfare of Iranian households as well as to state budget.

Today, Iranian government is struggling to modify energy pricing to abate electricity consumption. Therefore, it seems necessary to study the relationship between energy price and consumption with economical welfare of Iranian households by applying pricing mechanism.

A lot of diverse studies have been carried out on electricity market. The share of demand was higher in these studies because of its relationship between consumers' behavior. Extensive research has been done on the estimation of household sector's demand for electricity in recent decades.

Using the data for urban households' expenses and earnings in 1996-2008 and LES and AIDS, Mehdizadeh (2011) attempted to measure welfare impacts of higher prices of oil, natural gas and petrol energy carriers by compensation variation, equivalent variation, equivalent income and the true cost of living index. He found that governmental payment for the loss of consumers' welfare for energy carriers could compensate the direct impact of higher prices of energy carriers.

The empirical studies on electricity demand conducted in foreign countries, particularly in developed countries, are much better than those conducted in Iran in terms of history, quantity and quality. The followings are just a few instances.

Romero-Jordán et al. (2016) analyzed household electricity demand and its welfare consequences related to severe economic crisis and the intensive rise of electricity price in 2006-2012 periods by the quantile regression method. They revealed that economic crisis and higher electricity prices had damaging effect of the welfare, particularly among low-income part of the population.

He and Reiner (2016) was shown that in Chinese households there exists a threshold for electricity consumption with respect to income, which could be considered a measure of electricity poverty, and the threshold differs between rural and urban areas. For rural (urban) families, electricity consumption at the level of 7th (5th) income decile households can be considered the threshold for basic needs or a measure of electricity poverty since household electricity demand in rural (urban) areas does not respond to income changes until after 7th (5th) income decile.

Cetinkaya et al., (2015) was estimated price and income elasticity using the pooled data approach for the first time for the Turkish. The results strongly suggested that both the sector regulator EMRA and the private distribution companies ought to take into consideration the households' characteristics while designing electricity tariff following the envisaged introduction of cost-based tariff after 2015.

Meier et al. (2013) analyzed socioeconomic factors affecting households' energy costs in Great Britain by panel data in which they used the data of 5000 households for 1991-2007 periods. They estimated the relationship between energy cost and income and found that income elasticity was U-shaped in the range of 0.2-0.6.

In a joint study using tabular data of six years in 12 districts, Eshchanov et al. (2012) studied residential electricity demand in Khorezm region, Uzbekistan. According to their findings, short-term residential electricity demand has elasticity against low price variations. Also, income elasticity was found to be low.

Cebula (2012) used P2SLS to find factors determining electricity consumption in 2001-2005. According to this model, annual electricity consumption per residential customers was an increasing function of cooling degree days, real per capital personal disposable income and the real unit price of natural gas and a decreasing function of the real unit price of electricity and the extent of natural gas usage for residential heating.

Bushehri and Wohlgenant (2012) used a recent household expenditure survey in Kuwait to estimate residential electricity demand for different household groups (low, middle and high income), they found that the loss in consumers' welfare would be approximately US$145 million and the environmental benefits to society would be in the range of US$658-889 million.

According to studies in Iran, more research has been done in whole country and only a few of them is estimated the electricity demand in major provinces such as Tehran, Isfahan, Khorasan. In the present study, was focused on household sector. Household sector was selected because that is the biggest consumer of electrical energy in the country. This means that in 2012, the household sector in the province of Guilan have been assigned 43.8 percent of total electricity sales and was stayed in the first place (Energy Balance Sheet, 2012).

Given these facts, the aim of the present research was to study the effect of the increase in electricity price on residential consumers' consumption and welfare in rural regions of Guilan Province, Iran. So, the present study analyzes the residential demand for energy carriers in rural areas of Guilan Province in terms of electricity, natural gas, kerosene and gasoline for the 1991-2012 periods. Therefore, it was attempted to answer the question whether the increase in electricity price would influence residential consumers' consumption and welfare in rural areas of Guilan Province.

MATERIALS AND METHODS

Almost ideal demand system

In Almost Ideal Demand System (AIDS), the budget share of each commodity is considered as function variable and the logarithm of the price of all commodities of the commodity basket and the logarithm of real expenditure are considered as independent variables. The main feature of the system is that it is dynamic. That is, the income and price sensitivity of the commodities change over the time as the share or ratio of a commodity budget changes.

The system is in the following form (Deaton & Muellbauer, 1980):

$$W_{it} = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{m_t}{p_t^*}\right) \quad (1)$$

where, W_{it} is the budget share of the commodity i in the year t, p_j is the price of the commodity j, m_t is total expenditure allocated to commodity basket in the year t, and p^*_t is the Stone price index.

After estimation of system coefficients, Hicks-Marshall elasticity is calculated by the following equations:

$$\varepsilon_{ij}^{M} = -\sigma_{ij} + \left(\frac{\gamma_{ij}}{w_j}\right) - \left(\frac{\beta_i}{w_i}\right) w_j \quad (2)$$

$$\varepsilon_{ij}^{H} = \varepsilon_{ij}^{H} + w_j \eta_i = -\sigma_{ij} + \left(\frac{\gamma_{ij}}{w_j}\right) + w_j \quad (3)$$

Income elasticity is calculated:

$\eta = 1 + (\beta_i / w_i)$ (4)

But, the conditions of the estimated parameters are expressed as:

Additivity condition: $\Sigma\alpha_i=1, \Sigma\beta_i=0, \Sigma\gamma_{ij}=0$ (5)

Homogeneity condition: $\Sigma\gamma_{ij}=0$ (6)

Symmetry condition: $\gamma_{ij}= \gamma_{ij}$ (7)

Deaton and Muellbauer (1980), believe that the Stone index is a very good approximation for a correct price index. Although the Stone index was criticized after its introduction, none of the multi-step indices introduced then were faultless. It seems that the Stone index is the most appropriate index for the studies at household level because of the sample size and high number of commodity. The Stone index is generally in the following:

$$\ln a(p) = \sum_{i=1}^{n} w_i \ln(p_i) \quad (8)$$

where, ln $a(p)$ denotes the Stone price index, w_i denotes budget share of the commodity i, p_i denotes retailer price index of the commodity i.

Inferring compensating variations for AIDS

The function of Compensating Variations (CV) can be expressed as follows according to Laraki (1989):

$$CV=c(u^0, p^1) - c(u^0, p^0) \quad (9)$$

where, u^0 and p^0 are original utility and prices, respectively, p^1 is new prices, $C=\Sigma_i p_i q_i$ is expenditure function and qi is the demand for the commodity i.

Inferring equivalent variations for AIDS

By the definition of Equivalent Variations (EV), we have

$$EV=c(u^0, p^0) - c(u^1, p^0) \quad (10)$$

The estimation of the model and the calculation of the price elasticity allow studying consumers' behavior and the impact of price variations of residential electricity on welfare and consumption variation. This paper analyzes residential electricity price variations in an increasing scenario on the basis of Iranian Subsidy Reform Plan aimed at reaching the cost-based price of electricity in Iran and finally, approaching global price of residential electricity.

Since electricity, natural gas, kerosene and gasoline are measured and reported in different units, the amounts of all energy carriers were converted to million equivalent crude oil by conventional conversion coefficients. The prices of the carriers were also converted to million IRR (Iranian Rial) per million barrels of crude oil. Information of prices and the amount of energy consumption of different energy consumer sectors is extracted from the Energy Department's Energy Balance Sheet, also used National Iranian Gas Company (natural gas) and oil ministry (for other products) for additional information and statistics

RESULTS AND DISCUSSION

Electricity consumption in Guilan Province

Population, the volume of industrial, and economical activities and the climatic conditions are some factors affecting electricity consumption. In Table 1, residential sector, Guilan Province indicated the highest amount of electricity consumption of 1759.4 GWh in 2012 and in industrial sector, it was ranked the second with the electricity consumption of 964.7 GWh. In terms of the number of users, residential sector holds the first and commercial sector holds the second ranks.

The budget share of different energy groups in residential sector

Table 2 shows mean budget share of different energy groups in residential sector. As can be seen, electricity has the highest share in the budget

Table 1
Electricity Consumption by Different Sector in Guilan Province in 2012 (million Kwh)

Residential	Public	Commercial	Industrial	Agriculture	Roads lighting	Total
1759.4	396.6	360	964.7	368	170	4018.8

Source: Energy Balance Sheet, 2012

Table 2
Mean Budget Share of Different Energy Groups in Residential Sector

Electricity	Gasoline	Kerosene	Natural gas
0.472	0.01	0.263	0.254

Table 3
Mean Share of Different Energy Groups in the Expenditure of Residential Sector (%)

Electricity	Gasoline	Kerosene	Natural gas
38.79	0.46	22.16	38.59

Table 4
Results of AIDS Estimation of Energy Carriers in Residential Sector

Carrier	γ1	γ1	γ1	γ1	βi	R^2
Electricity	0.18	0.023	-0.18	-0.15	-0.078	0.93
Gasoline	0.023	0.014	-0.023	-0.015	0.0029	0.66
Kerosene	-0.18	-0.023	0.246	-0.154	-0.254	0.87
Natural gas	-0.15	-0.015	-0.154	-0.155	-0.1009	-

Table 5
Marshall Elasticity's of AIDS

Carrier	Electricity	Gasoline	Kerosene	Natural gas
Electricity	-0.7	2.4	0.68	0.1
Gasoline	-0.09	-1	-0.17	-0.01
Kerosene	-0.08	-2.39	-0.32	-0.36
Natural gas	0.22	1.5	-0.48	-1.1

of energy carriers used by households. Kerosene and natural gas are in the next ranks with a small difference. The share of gasoline is very trivial because of its low consumption in recent years.

Expenditure share of different energy groups in residential sector

Table 3 summarizes the expenditure share of energy carriers in residential sector. It reveals that the highest percentage of energy expenditure in the budget of a household in Guilan in residential sector is related to the expenditure of electricity. Natural gas is in the next rank with a small difference. The third rank is devoted to kerosene with 22.16%. Finally, gasoline holds the last rank with a very tiny share showing its very small role in energy expenditure of the households.

Estimation of AIDS model

Results of the model estimation are summarized in Table 4. All conditions of demand equations system including homogeneity, symmetry, and additivity conditions were applied to the estimated model. It should be noted that the coefficients of natural gas equation in residential sector were calculated in accordance with the limitations of AIDS.

The coefficients estimated in this are raw and will yield the income and price elasticities after substituting in the formulas described in Section 2. Finally, it is the estimated elasticity that can be analyzed and will explain households' energy consumption behavior.

Price and income elasticities

Since the share of commodity group is the dependent variable and the logarithms of the price of commodity groups and income are the independent variables in AIDS system, demand elasticities should be calculated in order to measure the sensitivity of demand to the variations of commodity price and income. Cross and income elasticities were calculated by the aforementioned equations for each commodity group whose results are shown in the Table 5.

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Table 6
Hicks Elasticities of AIDS

Carrier	Electricity	Gasoline	Kerosene	Natural gas
Electricity	-0.7	2.41	-0.68	0.31
Gasoline	0.52	-0.99	0.17	0.31
Kerosene	0.09	-2.39	-0.32	-0.35
Natural gas	0.5	1.51	-0.32	-1.1

Table 7
Income Elasticity's of AIDS

Carrier	Electricity	Gasoline	Kerosene	Natural gas
Income elasticity	0.83	1.29	0.05	0.6

As is evident in Table 5, own price elasticities of all four energy commodities are negative and as can be expected, there is a negative relationship between price and demand. The absolute value of own price elasticities of electricity, gasoline, and kerosene is less than one showing consumers' low sensitivity to these commodities. In other words, subsidy reform and the increase in their prices will cause less variation in their demands. Yet, consumers are more sensitive to the price variations of natural gas. Cross price elasticities of electricity exhibits a substitution relationship with gasoline, kerosene, and natural gas.

An important point to remember in interpreting cross elasticities is the importance of the consumption priority of the commodities. In other words, in the consumption pattern, even the relationship between two commodities, that is, whether one commodity is consumed beside the other commodity or substitutes it, may change (Farajzadeh, 2003). For instance, electricity has a substation relationship with gasoline, but gasoline has a complementary relationship with electricity. Yet, since most cross elasticities are less than one, the gross relationship between all studied carriers are weak.

The Marshall Price elasticity includes both the substitution effect and the income effect showing common or total demand elasticity. Yet, the Hicks price elasticity includes only the substitution effect of the price, and at best, shows substitution demand elasticity.

The Hicks price elasticities by themselves reveal the substitution relationship between the studied energy carriers. As shown in Table 6, electricity has a substitution relationship with gasoline and natural gas; however, only electricity has a complementary relationship with kerosene which is quite opposite to the relationship of kerosene to electricity which is just a weak substitution relationship.

According to the results, two electricity carriers are gross substitutes to each other with all groups. Only electricity is a gross complement of kerosene, whereas kerosene is gross substitute for electricity. Almost all substitution relationships found between electricity and other carries are less than unity, proving that weak substitution potential exists among energy carriers in household energy consumption.

According to Table 7, almost all income elasticities were less than one, implying the absolute requirement for these commodity groups. The expenditure elasticity of electricity was found to be 0.83, which is less than one. It shows that, as energy expenditure increases, the demand for this energy carrier increases but not as greatly as energy expenditure. The expenditure elasticity of natural gas was 0.6 and the income elasticity of gasoline was 1.29. It shows that 1% variation in total energy expenditure results in higher natural gas and gasoline by 0.6 and 1.29 units, respectively. The expenditure elasticity of kerosene was extremely low (0.05), which is much less than one.

Since only residential electricity price is considered in the present study, only scenarios for the increase in residential electricity price are considered to approach the price of 2012 to its cost-based price. Given this, the following sce-

Table 8
CV and EV of Different Scenarios for Residential Electricity Price Raise

Price scenario	CV (IRR)	EV (IRR)	CV/M	EV/M
50% increase	297356	207863	0.00035	0.00024
100% increase	593831	415692	0.00069	0.00048
Gradual increase (25% per year up to 4 years)	148467	103947	0.00017	0.00012

narios are considered for the increase in residential electricity price:

• 50% increase in residential electricity price
• 100% increase in residential electricity price
• Gradual increase in residential electricity prices in four years (25% increase per year)

Estimation of welfare indices

The following paragraphs describe welfare indices as affected by price change according to three scenarios— 50%, 100%, or gradual increase (25% per year up to four years) in residential electricity price. It is necessary to define a source (before policy implementation or before entering price shock) and a secondary point (after policy implementation or after price shock) in order to measure welfare consequences of eliminating or reducing subsidy, applying direct or indirect taxes and/or price shocks. In addition, it should be specified in what commodity group or groups the price modification (increase) has been applied. The price increase method and the source and secondary point can be determined in two ways: In one way, the applied prices are used and the effect of real price increase which has been recorded in the price indices of the Central Bank is defined as price shock, and its welfare impacts are studied. Alternatively, the effects of different scenarios on consumers' welfare are studied. The present study uses the second way and the price variations in two scenarios-50 and 100% increase in residential electricity price since 2012 – and their welfare effects are measured by the welfare indices of Compensation Variation (CV) and Equivalent Variation (EV). In the second method, scenarios are used, and the welfare effects of price variations are used in creating scenarios, and the welfare effects of price variations on consumers are studied in different scenarios.

Now, assuming that prices are constant in other studied groups, the welfare indices can be measured as affected by electricity price change. The results of these calculations can be made visible in different scenarios of residential electricity price increase if the prices of other carriers are kept constant.

As mentioned earlier, EV shows the amount of money that should be taken from households in order to hinder the implementation of price increase policy and the households reach a utility which they would reach if the policy did not implement. CV is the amount of money that should be paid to households to keep their welfare in the same level as before price increase. Table 8 shows EV and CV on the basis of 50% increase in residential electricity price of 2012. It shows that 297,356 IRR should be paid to households in order to compensate 50% increase in residential electricity price and to keep them in the same prior indifference curve. Regarding EV, 207,863 IRR should be taken from households to stop the implementation of price increase policy.

It should be noted that the calculated EV is less than the calculated CV due to the normality of the studied commodities.

Table 8 presents EV and CV values for 100% increase in residential electricity price of 2012. Results show that 593,831 IRR should be paid to households to compensate the price increase and to keep them in the same previous indifference curve. On the other hand, to inhibit the implementation of price policy, 415,692 IRR should be taken from households in order to reach utility which would have been reached if the policy had been implemented.

For the last scenario, the CV is 148,467 IRR and the EV is 103,947 IRR. As is evident, welfare indices are increased with the increase in variations percentage of electricity price so that the highest value of the indices is related to the 100% increase policy.

CV/M ratio can be used for better perception. It shows that to compensate electricity price increase what percent of household energy expenditure in residential sector (M) should be paid to the consumer to keep the previous utility and welfare (2012). This ratio is 0.00035 for 50% increase in residential electricity price. In order words, 0.00035% of household energy expenditure in residential sector should be paid to consumers in order to compensate 50% increase in price and keep them in the same utility and welfare level of 2012.

Similarly, EV/M ratio can be calculated too. This ratio shows if price increase policy is not implemented, what percentage of household energy expenditure in residential sector should be taken from them in order to reach the utility that would have been reached if the policy had been implemented. This ratio is 0.00024% for 50% increase in electricity price. But, 100% increase scenario increased CV/M ratio to 0.00069% and EV/M ratio to 0.00048%. The gradual increase scenario resulted in lower ratios than the other two scenarios.

On the other hand, since the share of electricity carriers in residential sector is 10.77% of total subsidy of energy carriers (Energy Balance Sheet, 2009), if mean monthly payment by the government to each person is regarded as 450,000 IRR, then each person receives 48,465 IRR/month for electricity consumption in residential sector. Assuming that a typical family size is 4 people in Guilan province, total amount received by the household is 194,580 IRR. The comparison of this received amount with CV for 50% increase in residential electricity price shows that the money paid for the household is less than the calculated amount. So, it can be said that the direct effect of residential electricity price modification (increase) is not compensated. In fact, the welfare loss of a household with 50% higher electricity price is greater than the welfare received. In 100% increase scenario, the gap between the calculated CV and total amount received by the households is the highest. But in gradual increase scenario, the calculated CV is less than the amount received by the households. So, it represents the only price policy which will improve households' welfare because price increase is slower in the scenario avoiding severe price and consumption changes.

According to the results obtained from Amini Fard and Estedlal (2003) who that estimated the household electricity demand in Iran, price and income elasticities of electricity was gained less than 1 in the long term since 1967 to 2000 periods.

Likewise, Poorazarm (2005) estimated domestic electricity demand of Khuzestan province and indicated price and income elasticities were 0.97 and 1.22 in the long-run, and -0.22 and 0.54 in the short run. In a similar vein, Ghaderi and Estedlal (2009) investigated the welfare changes resulting from the increase in electricity prices using compensatory Change Indicators (CV). Their results showed that the increase in electricity prices terminated to lose more welfare of households.

CONCLUSIONS

It is necessary to study the impact of prices and different policies on households' welfare if we want to understand consumers' behavior and to evaluate supportive policies, social security, subsidy modification, tax application, and any price modification policy. The present study reviewed the theoretical principles of the almost ideal demand system and then used this system to analyze the effect of higher residential electricity price on consumers' welfare.

It was revealed that the absolute value of income and price elasticity was less than unity. Low value of the price elasticity of demand shows slight effect of price variations on the demand for electricity in the studied period, on the one hand, and the lack of an appropriate substitute for electricity in residential sector, on the other hand. The main reason for low price elasticity is the low share of electricity expense in total household budget (Statistical Yearbook of Iranian Statistical Center, 2012). The income elasticity of less than one unit reveals that electricity is a necessary commodity in household consumption basket. Accordingly, the demand does not largely respond to expenditure variations. Since the price elasticity of electricity is less than one, severe raise of the price cannot reduce its consumption proportionately. Given the relatively low elasticity calculated for residential energy carriers, it is necessary to use other methods for reducing energy consumption in addition to raising their prices. Given the fact that electricity is a necessary commodity for residential sector, this sector should inevitably minimize its consumption for cooking, heating, and lighting, and in most cases, reducing its consumption means the loss of welfare would result in numerous health or sociocultural anomalies, and eventually, people's dissatisfaction. Therefore, it can be contended that the electricity consumption by residential sector is not a function of its price and household expenditure.

It seems that low coefficients of cross elasticities for electricity demand can be related to the following reasons: Electricity users in residential sector cannot respond considerably to the change in the prices of other energy carriers (kerosene, natural gas, and gasoline). It can be related to the fact that the technologies for the exploitation of electricity differs from those of other energy carriers. Then, consumers cannot quickly replace them to reduce electricity consumption as its price is raised. Even if it were technically possible, it would not be economical for consumers to change their consumption pattern and energy capital equipment with slight fluctuations of electricity price, especially given that these fluctuations are trivial as compared to its actual price. The quick replacement among energy carriers is only possible if the consumers have electrical, gas-fueled and oil-fueled appliances simultaneously. But it is obviously uneconomical due to opportunity, maintenance and other costs. So, consumers cannot inevitably respond proportionately to electricity price variations.

The cross elasticity of the demand for electricity is positive as compared to gasoline and natural gas and shows a very low value implying that firstly electricity is a weak substitute for gasoline and natural gas in residential sector and secondly limited raise of the price of substitute energy carriers like kerosene and natural gas will not have considerable impact on the demand for electricity due to their subsidization.

The welfare indices were calculated by defining three scenarios: 50%, 100% or gradual (25% per year up to four years) raise of residential electricity price. The comparison of the money paid to each person with the CV calculated for 50% increase shows that the money paid to the households is less than the acquired value implying that the direct impact of residential electricity price modification (raise) is not compensated. Indeed, the welfare that a household loses by 50% more expensive electricity is greater than the welfare it acquires. With respect to the 100% increase in residential electricity price, the value of the CV shows the highest gap with the total received amount of the family. However, the CV in the gradual increase scenario is less than the value received by the households and so, it is the only price policy by which the families will not suffer a loss and their welfare will be improved because the price raise is less steep in this scenario with no severe variations in the price and consumption.

Since the CV is higher under higher increase in residential electricity price, it is necessary for the government to increase the payment in the next steps to a level that the consumers' welfare is not lost. The present study can be used to calculate the appropriate payment for the next raises of residential electricity price.

With the implementation of the Subsidy Reform Plan, one method to offset the welfare loss of the families is to identify poor families and compensate the welfare loss due to price raise. In this sense, the clustering of the families in terms of their self-stated income may not work. One alternative way to recognize poor families is to use Proxy-Means Test (PMT) and such variables as personal and household's demographical characteristics (family size, householder's age, family dependence, householder's gender, householder's literacy level, householder's job type, the ratio of family members with earning, householder's marital status, household's housing, properties, access to living facilities, household's economic activity and living place) in order to determine households' welfare scores and to cut the subsidy of the prosperous families according to Article 10 of the Subsidy Reform Plan.

Since one main target of subsidy reform plans is to help poor people, then they can be helped by different ways after their identification. An example is the experience of some countries like Egypt in which instead of cash payment, they are given a specific card so that they can spend them for predetermined items in specific province or region. Also since the base payments are based on raised price of energy carriers, they can be granted to families as discount on the bills of electricity, water and gas. In this method, no cash is directly paid to families and if a part of the help remains after subtracting the bills, it can be spent for specific items like health and education. However, it should be noted that cash payment to people for a long time will create the expectation that the government has to make the payments in any conditions on the one hand and may deteriorate the inflation in addition to imposing a heavy burden on the government on the other hand. So, it may become inefficient in the long run. Therefore, indirect payment seems to be more appropriate, especially given the fact that it is fair to provide various helps on the basis of family welfare status instead of uniform distribution of the helps.

Given the small impact of price on residential consumption of electricity, it can be said that if the government is looking for the maximum earning by price raise, it is feasible; but if price policy is intended to be used as a lever for reducing the demand for electricity, it is not a suitable policy. Instead, the following policies are suggested:

• Changing electricity consumption pattern among households by education and motivating people to purchase high-efficiency electrical appliances.

• The use of motivating policies for domestic manufacturers of efficient electrical appliances.

• The control and prevention of the import of low-efficiency electrical appliances.

• Granting loans to families that are unable to renew their low-efficiency, old appliances.

• Motivating people to use double windows.

• Careful city planning so that all streets are directed so that most houses receive the most light in winter and the least light in summer.

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