DOI: 10.36347/sjebm.2014.v01i01.001

Scholars Journal of Economics, Business and Management e-ISSN 2348-5302
Maleki A *et al*.; Sch J Econ Bus Manag, 2014; 1(1):1-6 p-ISSN 2348-8875

(An International Publisher for Academic and Scientific Resources)

The Effect of Targeted Subsidies on Energy Consumption in Selected Teaching Hospitals of Mashhad University of Medical Sciences, Iran

Nasiripour AA[1], Maleki A[2]*, Ommi Sh[3], Shabani Jafarabadi G[3]

[1]*Associate Professor, Department of Health Services Management, Collage of management and Economics, Tehran Science and Research Branch, Islamic Azad University, Tehran, Iran*

[2]*M.A.in Health Services Management, Collage of management and Economics, Tehran Science and Research Branch, Islamic Azad University, Tehran, Iran*

[3]*B.A. Student of Nutrition, Tehran Science and Research Branch, Islamic Azad University, Tehran, Iran*

**Corresponding Author: Ali Maleki; Email: drnp20@yahoo.com*

Abstract: The energy is one of main factor of production in the world; However, we observe wasting energy in public sections and specially hospitals. Regarding to economical reform's implementation of targeted subsidies, the researcher in this survey decided to probe the effect of this scheme on energy consumption in public hospital of Mashhad. The data about amount of energy sources consumption and their costs in hospitals were collected by referring to the water, electricity and gas organization's websites. Ultimately, these data were entered in SPSS and were analyzed via T pair T tests & Kruskal wallis. Based on outcomes of the research, increase of energy consumption in a year after implementing targeted subsidies scheme were encountered in investigated hospitals. There was no relation between the amount of energy sources consumption in the year before and after the implementation of this economical reform (P>0/05). Two hospitals had a negligible negative growth rate in consumption of electricity however the test of Kruskal wallis targeted subsidies had no meaningful influence on energy saving. It can be concluded, setting up policies such targeted subsidies cannot results in energy consumption optimizing automatically and for obtaining this goal, the right management of energy consumption and the accurate implementing of the energy consumption optimizing's method is necessary.
Keywords: Energy Consumption, targeted subsidies, hospital

INTRODUCTION

Nowadays, energy beside the capital and manpower is regarded as one of the principal factors of production in the world and in our country energy plays a tremendous role in progress and development as well[1]. States should undertake their obligations individually or cooperatively via great measures and policies such as regular interventions of market in order to decrease the economical, social and environmental adverse effects of energy sources consumption like fossil fuels. In the energy replacement's scenario of International Energy Agency (IEA) it seems that the policies that governments are now implementing (Like reforms of Energy subsidies) would reduce the consumption growth and fossil fuels exploration to the half of it until 2030[2].

Whereas, the production and consumption of energy in Iran is far away from optimum situation and the intensity of energy consumption has been mounted considerably in Iran during the last years[3], though codifying strategies and appropriate policies with consideration of the predicted situation in future and codifying commensurate schemes for optimal energy allocation and utilization of that has high importance[1]. Efficiently utilizing of energy can be of potential and effective ways for resolving the world's energy problem[4]. At a glance through the energy consumption's statistics and important indexes such as the maximum energy consumption, the energy intensity and energy efficiency and comparing it with other countries we find out that in global competition arena that is approaching towards less consumption (optimization) and more production we observe wasting vast amount of energy in transportation, housing, industry & public_ governmental sections especially the hospitals [5]. Building official departments is one of the fastest and most growing portions of construction industry. On the other hand, the energy consumption in official constructions is about 70 to 300 KW per hour on square meter that this amount is 10 to 20 times more than residential section [6]. Iran constructions consume energy six times more than European countries averagely and 40 percent of electricity and nonrenewable energy is consumed in construction sections in the country[7]. One of principal types of official constructions which has potential of undertaking the saving measures for energy is hospital[8]. Facts and figures which are provided in researches, conducted in relation to health care, demonstrate that because of the importance of variety hospital's facilities utilization, energy consumption in each square meter is much more than other types of service institutions[9]. Because of the bellow

mentioned causes hospitals encompass a great quota of energy consumption. Causes such as: 24 hours working of this organization, the large size and area of the construction, need for hot water, need for cooling and warming facilities, sterilization facilities, and presence of variety of medical facilities.

On the other hand, according to conducted researches in the country, the potential for reducing energy consumption is estimated about 40 to 50 percent[9]. Although Yaklious's study, in association with high capacity of hospital for saving energy indicates that, energy consumption can be reduced up to 10 percent without any special budget while this saving is possible in developed countries like Germany up to 20% and Holland up to 44% [10]. The hospitals and medical centers are regarded of the most vital institutions of each society. Their strategic situation in dealing with critical incidents and their fundamental role in increasing the health rate and the sanitary welfare of society have increased the sensitivity of the matter. On the other hand, the high number of these centers and their high need for energy sources and also their long hours working (Most of these centers work 24 hours daily) lead to particular importance for audit of energy consumption in medical centers.

As the energy costs in hospitals takes 5 to 7 percent of budget or in other words about 10 percent of current hospitals expenditures is invested for purchasing the energy sources. Therefore the increase of these sources consumption can have considerable influence on hospital expenditures and the health section so investing effort for reducing energy consumption is a requisite for them. The price of energy is one of the variables which is controlled externally by government in Iran's economy. Because, on one hand, energy is vital in all economic sections and on the other hand all economical sections have interaction with each other. Thus, any change in energy cost would affect the whole economy and it would have considerable outcomes[12]. The initial investigation indicates that if the cost of energy sources increases it is possible that the expenditures of governmental Sanitary and Medical Centers would mount up to 700 billion Tuman [13. Because the great portion of non-personnel expenditures is invested in energy costs and it affects the final cost of every unit which provides services to hospitals directly[14]. Regarding the role of energy in the stable development of the country and increasing the cost in order to approach the global prices, operation of managers in energy section with the purpose of obtaining the organization's aims in order to optimize usage of energy with lowest price is necessary to be assessed accurately and constantly[15]. Because monitoring the energy management is important for every determiner company in order to present important data, concerning to how to diagnose the process of consuming energy, for their activities. This can be the best help for the senior manager of official company for important conclusions and predicting outcomes[16]. In 1980s following the debts crisis and the global stagnation and conflict of east-Asian, Latin America, South -Asia & African desert, the development strategies emphasis changed through progress of economy management and acknowledgement the more important role of bazaar powers that in new frame most of the countries take measures for reforming subsidies schemes[17]. Based on what is recorded in history of global economy systems most of the states take action in implementation of reforming scheme or targeted subsidies. The scheme which suggests the measures that government guides and directs the subsidies to the proper and targeted groups[18]. In recent years, because of various reasons such as gradually omitting the governmental subsidies more attention has been attracted to the value of different types of energy and necessity of counting amount of consuming and saving energy has come out as a firm and inevitable requisition[3]. Many articles are written about subsidies and their effects but most of these articles have been concerned to agriculture ,natural environment and transportation and also these studies have been undertaken in industrial countries mostly[19]. The Iran economy was passing from centralized planning through non-centralized planning and subsidize was one of the most important affairs in this transition period. The importance of this point becomes evident by finding out that a great portion of national budget is invested to subsidization annually. For example in 2002 approximately 120574 Milliard Rials was invested to energy; Therefore, the discussion of omitting subsidizes has high sensitivity[20]. In the report published by the International Energy Agency in 2006 declared in the 20 big non-member countries of Organization for Economic Co-operation and Development(OECD) about 220 $ has been invested for energy source's subsidize that from this amount 170 billion dollars is invested for fossil fuels. Among these countries; Russia, the biggest on, has spent about 40 billion dollars and astonishingly Iran with 37 billion dollar expending is in the second grade.(The grade which places Iran in energy sources consumption higher than China, India, Egypt and Indonesia.)

As subsidies tatgeted needs revision of energy prices, the field of economy would encounter with increase of prices; therefore indentifying the targeted subsuidies's effects and undertaking processes that minimize inflation effects and adverse consequences are of paramount importance [21]. In recent years because of various reasons such as gradually omitting the governmental subsidies, more attention was attracted to the value of different types of energy and the necessity of accounting energy saving and consumption has become known as a firm and inevitable requisition.

The purpose of this study was investigating the effect of targeted subsidies scheme implementation on amount of energy sources consumption (electricity, water, gas)

MATERIAL AND METHODS

In this semi-empirical research, teaching hospitals of Mashhad Medical University-Iran in a 3-year period (2009-2012) were probed during a year before and after the targeted subsidies scheme implementation so it can be considered cross-sectional Also the present research from before and after intervention studies and in terms of its results can be considered operational.

The data were collected with direct observation and utilization of note taking method investigate consumption and expenditure experiences such as the number of in-patients and the number of active beds from recorded statistics of the investigated hospitals.

In addition, for collecting data concerning to energy sources consumption and respective expenses, technical offices and accountancy units were referred and subscription number of water, gas and electricity meter was gained. Afterward the concerned data to the amount of energy sources consumption were collected via the websites of Abfa, local electricity and Mashhad gas organizations and ultimately arranged in the charts of SPSS software. As far as the present research is of before and after type, for determination of meaningfulness of difference between amount of energy sources consumption before and after targeted subsidies scheme implementation, Pair T-Test has been utilized. Also for assessment the effectiveness of these subsidize reforms kruskal wallic test has been used.

RESULTS AND DISCUSSION

Findings of this research is result of researcher's hypothesis analysis in three parts. The first part of the hypothesis mentions that there is difference between amount of consuming electricity, gas and water a year before and after targeted subsidies scheme implementation in investigated hospitals and researcher utilized Pair T-Test for rejection or verification of these hypotheses. Resultant findings of the theories' first part analysis has been brought in the first chart and indicate that between energy sources consumption in targeted hospitals a year before and after purposive subsidies no meaningful differentiation has been pertained(p-Value<0/05). Only for amount of gas energy consumption related to number of in-patients the numeral outcome of the test leads to endorsement of the theory and also this differentiation was not in the desirable direction (consumption reducing).

Table- 1: Results of Pair T-Test for scrutiny of meaningfulness of the amount of energy sources consumption's change in a year after targeted subsidies scheme implementation

Gas consumption related to number of active bed	Gas consumption related to number of hospitalization	Electricity consumption related to number of active bed	Electricity consumption related to number of hospitalization	Water consumption related to number of active bed	Water consumption related to number of hospitalization	Ratio of energy consumption Test's details
-2.142	-3.488	0.134	-0.771	-1.552	-0.495	Measure of test's statist (T)
5	5	5	5	5	5	Freedom degree (df)
0.085	0.018	0.898	0.476	0.181	0.641	Meaningful level (sig)

The second category of hypotheses has conducted the amount of energy consumption growth's comparison in a year after targeted subsidies and indicated that among the targeted hospitals in terms of water, electricity and gas consumption in the before and after years of subsidies reform the difference is pertained. Along the same long, for determination of these theories verification it was necessary to homogenize and unify the hospital's concerned data initially, thus by division the numeric amount of water, gas and electricity sources energy consumption into number of each hospital's in-patients and active beds homogenization is done and through this way different hospitals can be compared with each other in terms of energy sources consumption growth rate in a year after the program. Only a hospital has the negative growth rate in water consumption among all hospitals. Except two hospitals, other investigated hospitals in a year after targeted subsidies, had positive growth rate in consuming electricity.

The third section of graphs (5 and 6 diagrams) is about measure of gas consumption's growth rate in investigated hospitals in a year before and after targeted subsidies implementation. These graphs, same as the last graphs, illustrate this fact that there is a great

difference between targeted hospitals in terms of gas Energy consumption's growth rate. Eventually, we will find out by observing the sixth graph, that growth rate of energy consumption in investigated hospitals were different with each other, so researcher's hypothesis is confirmed in this section.

The last part of the research's hypotheses challenged the effectiveness of targeted subsidize implementation scheme as an independent variable on energy sources consumption such as water, electricity and gas in six medical university hospital of Mashhad as a depended variable. The result of karuskal wallic which is illustrated in chart 2, showed that the numeric amount of test's meaningful level for amount of water consumption (related to in-patients and active beds)in a year before and after targeted subsidize scheme implementation were 0/749 and 0/423 that both of them were more than 0/05. This test's output for electricity consumption was 1 and 0/873 and associated with gas energy source 0/423 and 0/749 numbers were derived That all of those numbers were more than 0/05, so this hypothesis (the targeted subsidize implementation scheme is effective on energy sources consumption in investigated hospitals) was rejected. It means the targeted subsidize implementation scheme did not have the considerable and meaningful effect on gas consumption in Mashhad medical university hospitals.

The findings of this research have stated this fact that in the investigated hospitals in a year after targeted subsidize implementation scheme , not only any reduction occurred in rate of energy consumption, but also most of the hospitals encountered with increasing in rate of Energy consumption. Therefore, only Ebne Sina hospital in water and gas consumption's rate, and Dr.sheykh and Omid hospitals in electricity consumption' rate had negligible decreasing, so we can conclude that, considering the investigated hospitals are governmental institutions and their budget is provided by government, targeted subsidize implementation scheme can not provide the critical agents of energy consuming reduction automatically.

The measures which have taken by these three hospitals (Dr.sheikh, Omid, Ebnesina) indicated that even these negligible consuming reductions were not accidental and reasonless and in addition to the targeted subsidize, the well management of energy had desirable effects on optimizing energy consumption. The results of Nasiripour & his colleagues's study in this context indicate that the consumption of energy sources such as electricity and gas increased in a year after subsidies's reforms but the consumption of water decreased. Besides he has pointed out to increasing the consumption of energy sources after targeted subsidies implementing scheme in all of his findings; however, the results of this study has been just associated with one hospital and most of the concentration was on hostelling costs that from these aspects was different from present research.

The obtained results of pair T-test with confidence index of 95% that were used for verification of the first part of research's hypotheses showed that P-Value was derived more than 0/05 except in one case and therefore this hypothesis (there is difference in investigated hospitals between rate of energy sources consumption in a year before and after targeted subsidies implementation scheme) was rejected in this study. According to the associated findings with the second part of research's hypothesis that it compared hospitals in a year before and after targeted subsidize in terms of energy consumption rate and via sextet graphs, the Imam Reza hospital had the highest growth rate of water consumption and the Ebn sina hospital was the only one which had the negative growth rate. Dr.Sheikh and Omid hospitals had the negative growth rate of energy consumption concerning to electricity energy source and Hashemi Nejad hospital had the highest rate of energy consumption in this field and finally Ebne Sina hospital had the negative growth rate and Imam Reza hospital faced the highest growth rate of energy consumption. From these findings (The different pattern of energy consumption) it can be concluded that omitting the energy subsidies can not be the main factor for reforming the pattern of consumption and making change in energy consumption rate in hospitals depends on factors such as highlighting the role of technical offices in hospitals.

The final findings of this research which were obtained by kruskal wallis test indicated that the targeted subsidies scheme implementation was not effective on consumption of any energy sources, because with 95% confidence index rate none of the tests became meaningful and this hypothesis that ((the targeted subsidize implementation scheme is effective on energy sources consumption in investigated hospitals)) was rejected. The researcher

Concluded from these findings that not only the hospitals but also all the institutions and organizations for decreasing the energy consumption need a correct and scientific management in energy consumption field beside the targeted subsidies.

One of the ways of decreasing electricity consumption, is educating and promoting culture of consumption, assignation a manager or energy expert and formation of consumption pattern reformation committee in hospitals. About the aforementioned subject Sheikh Abo Masoudi and his colleagues stated that an appropriate way to control all energy systems of department is to use managing energy system which

automatically controls heating system, air condition, boiler and lighting.

Jabarvand & his colleagues, that showed in their study 31&28 percent decrease in water and gas consumption in a year after targeted subsidies, explains in conclusion of his research that utilizing the methods of energy consumption management in farabi hospital has lead to this reduction in energy consumption [3]. Alavi (2012) also states about energy consumption after optimizing energy sources consumption that in case of reforming the energy consumption method this matter can be reduced up to 20 % ; the potential of reducing electricity energy source consumption is from 130 Kw per hour on square meter to 100 Kw is pertain.

Dog and his colleagues obtained different results in their research, their results indicated that the high costs of energy sources can leads to a considerable decrease in energy supply and can results in changes in energy consumption(From Fossil fuel to clean energy) and also the increase of energy cost can leads to 4/1 to 6/4 percent decrease in production of carbon dioxide and this prediction concerns to 2030; However their results were concerned to Germany's society and they did not investigate a particular hospital.

CONCLUSION

Ultimately, it concluded that regarding to the conducted statistic analyses and the results of other researcher's studies the implementation of such policies (targeted Subsidize) can not lead to optimizing energy sources consumption and for achieving this goal correct management of energy consumption and accurate implementation of optimizing energy consumption methods is necessary.

Acknowledgments

The paper authors appreciate from the management and personnel of investigated hospitals for their friendly cooperation in the research presentation.

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