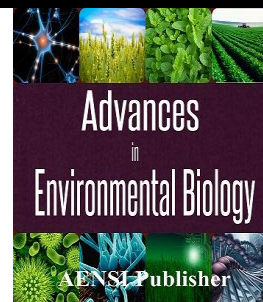




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Performance Efficiency of Power Plants Under the Ministry of Energy during-1988-2010 Aspects of Fossil Fuel Consumption

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ABSTRACT

Each country's power generation plants can be important and necessary factor in the growth and development of the country called. The budget for each new plant construction and the much needed foreign exchange and capital due to the power industry is required; the optimum use of available resources can be spent on other opportunities that are facing liquidity shortages. The fundamental question is whether the existing power plants can generate electricity with a capacity increase of current for this purpose in this paper, the efficiency of power plants under the country's electricity production are more than 90 percent during the 67-89 has been studied using data envelopment analysis And productivity growth using Tornqvist Productivity Index is calculated. The results show the efficiency of power plants in recent years towards reducing the scale of their activities. In addition, productivity growth in fossil fuels during the study period is irregular. Is the average efficiency of electricity production under constant returns to scale is 95.5 percent and 98.2 percent had to scale is variable.

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INTRODUCTION

The power is one of the energy type which for special characteristics is more Important than of other type. Generally, importance of power producing, it's benefit as heat , as light and other benefit for human activities. The power that is cleanest energy can be produced by available aquatic potentials, non clear energy, modern energies and finally fossil plant which for their pollution dispersion be built in specific places. It's clear. The importance of power productivity so that in 133 provision of fifth plan law, for increasing plant's efficiency, decreasing dissipation and concurrent expansion of power product on Tavanir co and dependent companies under ministry of Energy, some commands be considered also in subsidy goal orientation law on chapter problems relating utilization promotion and efficiency and productivity be regarded and by announcing relating coefficient, definite special assignments for power industry. As well as increasing efficiency product proposal for more using of performance investments and available potentials on power industry plants on 1999 is defined, and be started at first of third country development plan.

The end of performing this design is identification of decreasing outputting factors and plants thermal potency of power industry and make solution for remove of this limitations.

Also performances and precasting progress, increasing productivity of new servers to minimize of wasting is defined that performances of controller organizations and commands navigate the importance of topic. If we consider productivity as results of data envelopment analysis and goals for product and lab our define. It's necessary to consider this point that efficiency and effectiveness the two essential. Elements of productivity on system productivity.

Then in this research we consider productivity of fossil fuel consumption on power industry that its need to analyze indexes in this industry so that we use nonparametric methods, so first step for improving industry power's application, it's necessary identification available power production. It mean's that first we must measuring the efficiency and growth production productivity undergoing of ministry of energy to patch finding optimal a situation. So that in this study we measuring productivity and efficiency and considering factors of Effective. At the end of this study wheat her power plants generation Ander ministry of Energy and its tables

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perform effective's or not. To calculation of productivity we use the methods of data envelopment analysis and tornqvist productivity index. This index in condition of existence of any decibel unit in every period would compute the total factors productivity growing and separate the results to varieties of efficacy.

Then this question ask forever about function(application) of plans and the plans under the ministry of Energy specially so that. What is the scale of productivity against consumption fossil fuels. In this study we attempt to expres plans efficiency and efficiency or none efficiency of plans under ministry of energy in fuel consumption and finally fuel factors productivity.

Also today, greenhouse gas emissions, is a global basic problem. fossil fuels is a source of greenhouse gases. The volume of greenhouse gases is changed due to chemical reactions leading to climate change. On "Earth Session", 1992, Rio de Janeiro, Brazil, governments agreed to think of a remedy for climate change. Kyoto Protocol was enacted in United Nations conference on 1997, Kyoto, Japan. The purpose of this protocol is to induce the volume greenhouse gases emitted by developed countries; so that, during 2008-2012, the volume of GHGs would be at 5% less than its volume on 1990. Totally, 174 countries ratified this protocol. [14] Thus, the importance of environmental review of electric energy production is important

1-1 power and fossil fuels:

Today, one of the most important environmental issues that pose international threats is global warming and, as a result, climate changes. As a result of the researches led by developed nations to detect adverse effects of human-originated greenhouse gas emissions, which have already reached dangerous levels in the atmosphere, on the climate system, the need to take global action about this matter has been revealed. Kyoto Protocol, which is adopted in 1997 and now considered as the most significant international effort ever made to minimize the effects of global warming and climate changes, is of great importance for determining the obligations to reduce greenhouse gas emissions and the applicable mechanisms. [16]

We must pay attention to this point that one of the infection of power generation is dispersion of polluted gases. Continuum need to energy by considering growth population and subsequently power consumption and fossil fuels increasing in Iran and other countries in past leads to make dispersion of many of pollutants types and green house gases in the ground. For example the proportion on of pollutant dispersion by Iran's plants in 2010 more than of it in 2005.

More over, abundant of energy resources and it's inexpensiveness specially in many of Oil developing countries as Iran, make increase this materials constraction and drastic air pollution in this areas. Air pollution that is result of fossil fuels ignition.

Pollutants such as sulfur oxides, nitrogen oxides, carbon monoxide, suspended solids, carbon dioxide and unburned hydrocarbons from the various known types of materials that are discharged into the atmosphere by the use of fossil fuels, In general, the material from the combustion of fossil fuels are classified into two major groups. Some of these materials, such as carbon dioxide normally present in the atmosphere and cause air pollutant as are not by nature, but increases the release of these substances into the atmosphere and cause greenhouse effect increases the phenomena such as the Earth temperature.

Is its subsequent. It's necessary that there is many impressions of this when ther increasing is an known for human. Other group of this pollutant materials as sulfur oxides, carbon monoxide, nitrogen oxides that are main factor of air pollutant in urban areas specially and threats humanity and creature's life. Also combination many of this pollutants with air humidity makes acid rains.

That it's results such as spread(vast) forests destruction dirt and pollution in many countries, north Europe specially is revealed and damages has imposed to this countries.

There fore, we consider that results has been made by fossil fuels consumption imposed harness to human. Animates an biology of that areas. Ako in many cases adjacent countries and some when other continents of world be influenced 50 optimal usage of limit resources energy and decreasing pollutions dispersion has been a raised out fossil fuels ignition is essential. Be aware if we spend 1 Rial petroleum in petrochemical industries beget more than of 20 Rials. Direct added value. Thus power generation by using fossil fuels is more expensive because of in addition to direct costs production makes social eats by environment pollution and loses added value in petro chemical by devoting fossil fuels to fossil fuels and fossil fuels is valuable naturally. For example price of one petroleum keg has risen more than of 100\$. Than we should use new and renewable energies as wind power, geothermal, solar energy and etc, instead of fossil fuels and plants with rather out put. Ther fore simultaneously by economic, on usage of untenable fossil energy resource. We can not of this arccoss resources more optimal[1,2].

1-2 Research history:

Data envelopment analysis Method is one new approach rather for Meter to total of firms efficiency. This approach(Method) at first in 1978 discusses by charnze, cooper and Roodes. In this Method we use Liner playing for popularization or farel efficiency index to Meter of determinant unit work.[3]

linear planning usage as in data envelopment analysis more than of 3200 papers(Articles). Between of 1978 to 2001 be done in this studies in many fields such as hospitals efficiency didactic evolution centers, plants, industries and agriculture section[4].

Also parametric methods be used. About power companies interior exterior Researchs have been done in bottom have been explained. Roberts(1986) in study thriving aris out from density and measuring in generation and of delivery power called. By using of cost function estimation of 65 private power companies(company) of united states of America compute this thriftings by regarding this point that power companies are vertical in this country then we use two step function for estimate this cost function-in first step, capital amends', labor, purchased fuel and power to minimization of choice generative KWH power factor and in second serf this KWH's by capital and labour factors of transit sector and distribution combine to minimization of received high religious therefore this voltages are dissipated geographically so Companies physical features specially their size unto square mile and number of clients as exogenous limits discussed on cost function finaly total cost of powers apply influenced by this factors: $czf(P_p, P_T, P_D, P_M, O_H, A, N)$

In that sequence P_M, P_o, P_T, P_p reality factors price, unto kn capital of rial transformation, capital of distribution and labour section. QI, QH are sequenc high and low voltage for costumers, A is distribution area size by square mile. And N is number of costumers. To estimate cost function translog function is used. And by using of this function elasticity related to each of variables and volume of out pot to product density. Costumers density and size is estimated. Results shown that costumers density and area Size, Ne Main influence on decreasing of cost[5].

Brenz andas, Jkones, evaluate economic efficiency and factors that influence an application(function)of distribution power companies of England by using of Stochastic frontier and cost Translog function results of this research show that economic efficiency average of this companies his 1.66 and factors as private ion. Year of establish of this company, lines length and trans for transform capacity are impervious en their efficiencies. Also this results confirm economies of scale on industries of power distribution of this country. Fersond and kitles(1998) tochecking the productivity Method procedure power distribution of Norway, evilate productivity growing of 150 power distribution by using of productivity malmquist index on 1989 and 1983 for this country. It's out put are:

- 1) clients (customer) aggregation
- 2) a number of clients
- 3) electricity delivered volume to clients and inputs such as:
 - 1) the labor
 - 2) capital
 - 3) crude Material
 - 4) wasted energy.

Salvantz and tjuta in study 11 differents of productivity on tuple inputs (using on power energy)" to determine long time productivity accounts of power companies by using of cost short me function, estimate by this assumption that fix input is optimal(best phase) of Norway in 1998. Result shown productivity growing in this power in power industry is positive, important reason of positive productivity growing been decrease of energy wasted [6].

Flipini in a study surrey economic efficiency of 50 companies of power distribution for Switzerland country between 1988 to 1996. From results of this study Economies of scale on power companies of this country and increasing of efficiency of this antis a during this time. average of economic efficiency this companies been 1.15 during this time.[5]

Hatory in his study, check sand compares efficiency of power distribution companies of Japan and USA bet ween 1982-1997 by using of Tran slog accidental: Frontier Production Function . Results shown that environmental factors such as economic condition and managing history affection efficiency of power distribution of Japan companies and this companies had higher average of efficiency rather than American companies.[7]

Corhonen and hoptasic to Meter (Measuring) of environmental efficiency use two Method in first Method outset they computer technical efficiency by regarding relationship between good output and bad output and then compute environmental efficiency by regarding relation ship between good bat output. Combined of this two efficiency, applied eviction extract for evaluate to environmental application of the plants. In second method, bad out put use as a input and compute efficiency so that outcome results that arise out of this two Method are similar together. [7]

Young and polit in a study checking the environmental efficiency for 582 consumer plants of coal fuel of china country in 2002 year. Annual product as good input and amount of dispersal of the gases such as carbon dioxide, Nitrogen dioxide and sulfur dioxide as bad input is regarded. [7]

Falahi and Ahmadi by using of accidental border Method in the form of combination error Method of rates and coli between 1883-2003 check the economic efficiency of companies of khorasan state. Finally results of this study shown that average of efficiency cost of this companies was very low near by 98.3. Another result is lack of exit of and necessity of increasing of Number of power distribution companies in this way.[8]

Naserzadeh check the environmental) efficiency of plants of Iran between 2003-2007 that inputs of power product and dispersion of carbon dioxide use for as good and bad inputs and the labour. Consumed fuel and

nominal capacity of plant as input. Result arise out from Data Envelopment Analysis (DEA) Method shown that, the efficiency of 40 plants under check during under check is decreased also between environmental efficiency and consumed fuel type is semantic (definable) relation ship.[3]

The purpose of zarengad and Hajiabad's study is evaluation of economic efficiency of power distribution companies of Iran, estimate the economic efficiency of power distribution companies of Iran and denotation of effective factors on it by using of accidental border fun?. So that panel datas of 41 companies of power distribution company of Iran between 2003 to 2006 is collected and economic efficiency of this companies by using of combination error models and remnant of inefficiency. Of Bates and coli is computed results shown that average of economic efficiency of power distributor companies during period under study in the form of Bates and coly's first and second samples. That 1.74 an 1.65 sequently[8]

The researchs from the past express that distinction of this research rather than previous research is using of Tornqvist Productivity Index to Meter the variation of efficiency and productivity during the time just one decision unit is excited. In other word in recen decades a great efforts to compute the efficiency and productivity by two Method parametric and nonparametric that more of their compute the efficiency and productivity. But in here we declare efficiency of power generate as only one determinable unite.

2- efficiency and productivity:

Upon we hear two word productivity and efficiency we imagine that what is difference between efficiency and productivity. There are two definitions of efficiency: first definition is $\text{efficiency} = \text{input/output}$ and second definition $\text{real input} = \text{efficiency}$ [9-10]. Generally two definition for productivity is exit: A) parametric Method of product Frontier Production Function , clear product Frontier Production Function statistical clear product Frontier Production Function , accidental product Frontier Production Function , profit function of many parametric Method. B) nonparametric Methods: this Method based on a optimization serie to computation of efficiency ratio that be done by using of mathematical planning.

DEA Method is one of the nonparametric Method that in it outputs is near by maximum by regarding inputs or by using of both of it. To product the certain out put, output is near by minimum.[11]

about productivity very different of definition is available. Generally productivity is: the relation ship between concluded utility and consumed resources on system during the two period that one of it is base. Other definition for productivity is sum plus of efficiency and effectives that $\text{productivity} = \text{efficiency} + \text{effectiveness}$. Methods for computation of productivity is this:[12].

3) datas and statistic:

Also productivity index like the labour and capital, measure rate of goods output and productive service versus input with in DEA promote, Energy productivity can accomplish by reducing the Energy input need for produce deal of energy services or increase of quantity or quality of output economic activities. Energy out put inder gets from division of product values on amount of consuming Energy. (inverse severity of final Energy consume). Power as first or second output produced in plant total of input power nominate as impure power. Plants consumes amount of power for it's domestic needs. Special produce of power get from fraction of this amount of impure product this special product distributes to consumer by national network of transmission and distribution.

Account of products in year, shows the total practical capacity in plants product of ministry of power in below figure.

Main fuel that consume in country plant's is natural gas and it's substitution fuel for steam plant is oil store for gas plants and synthetic cycle is gasoline.

Gas fuel consumption for several reason prefer on liquid fuel such as; decrees of bad environmental effects, fast operation and less cost of repair and keeping. Thus actions fore institution of facilities of gas transporting for multiple plants. So according to statistic limitation, inputs variable is gasoline, oil and natural gas consumption for plants in year and outputs variable is practical capacity of Electric energy in year.

4) efficiency accounts and efficiency grow:

Improving of power system is part of energy planning and generally based on specific policy of development in country. Power producing is based on national beneficial and do agreement with rate of increase application of energy in country. Couldn't save Electric energy and must consume with producing concurrently, hence production management encounter with specific limitation for suppling electric energy and just do management toward consumption management or application management that in this field two agent is consider: one is consume in actual and optimize and other transfer of consumptions from peak time to other day ties that first agent decrease consumption and second agent follow decrease of network pak. Therefore in efficiency account use capture way. Thus result of technical efficiency with assumption of variable output show in table(1).

Table 1: Technical efficiency.

year	Managerial efficiency	Efficiency with return variable	Efficiency of of scale	Returns to scale
1988	1	1	1	-
1989	1	1	1	-
1990	0.939	0.997	0.941	Increasing
1991	0.911	1	0.911	Increasing
1992	0.942	0.988	0.953	Increasing
1993	0.959	0.993	0.966	Increasing
1994	0.999	1	0.999	Increasing
1995	1	1	1	-
1996	1	1	1	-
1997	0.961	0.977	0.984	decreasing
1998	1	1	1	-
1999	0.909	0.956	0.951	-
2000	0.863	0.922	0.936	decreasing
2001	0.841	0.898	0.936	decreasing
2002	0.895	0.94	0.952	decreasing
2003	1	1	1	-
2004	0.97	0.983	0.986	decreasing
2005	0.968	0.978	0.99	decreasing
2006	0.97	0.973	0.998	decreasing
2007	0.971	0.978	0.993	decreasing
2008	0.931	1	0.931	decreasing
2009	0.926	0.997	0.93	decreasing
2010	1	1	1	-
متوسط	0.955	0.982	0.972	-

Now by using of resulted elasticities that arise out from DEA models, indexes of output and in put Tornqvist compute that expressing output variation and factors during two years, and the growth of total factors productivity= out put Tornqvist index as mentioned in table(2).

Table 2: Total factor productivity change.

year	Total factor productivity change	Efficiency change	technical efficiency change
1989	1.04	1	1.04
1990	0.96	0.94	1.02
1991	1.03	0.97	1.06
1992	1.07	1.05	1.02
1993	1	1.01	0.99
1994	1.22	1.03	1.18
1995	0.85	1	0.85
1996	1.14	1	1.14
1997	0.92	0.98	0.94
1998	1.43	1.02	1.41
1999	0.77	0.95	0.81
2000	0.92	0.98	0.94
2001	0.95	1	0.95
2002	0.97	1.02	0.95
2003	1.25	1.05	1.19
2004	0.87	0.99	0.88
2005	1.01	1	1.01
2006	0.86	1.01	0.86
2007	1.05	0.99	1.05
2008	1.01	0.94	1.07
2009	0.92	1	0.92
2010	1.07	1.08	1

It seems that by using of DEA Model and by using of Tornqvist Productivity Index growth of total product productivity of establish ment depend on power ministry during the persistent period from 68 to 89 and also variation of product that arise out from management efficiency and technology during of each period. Indexes process is shown in below diagram(figure). Figure (1) show the growth of total productivity and efficiency change and technical change from 86 to 89. Most efficient year about consumption of fossil fuels to power generation is 1996 that interesting point is that in this year generation of Diesel plants has decreased. By regard to Figure 1 and table 2. Most growth of Total Factor Productivity (TFP) has occurred in 1998 year. In 2000 year that start of power generation by cycle combination plants. Efficiency and productivity don't increase but decreased. In 2002 year that windy plants and solar plants start the power generation efficiency grow up. But productivity have been decreased. But in 2003 year both of efficiency and productivity have been increased. In

2009 year Biogas burner plant is established but efficiency and productivity haven't been increased. Before 1996 year, generation of power and later of 1996.

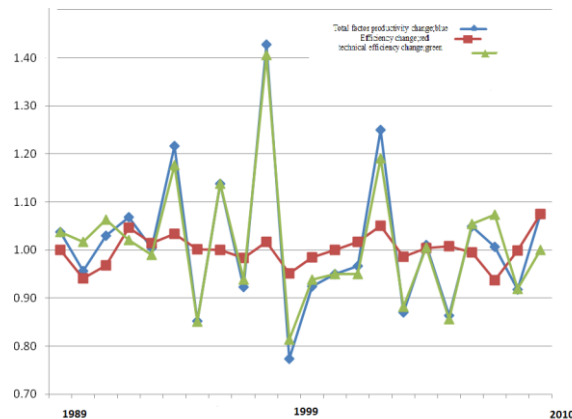


Fig. 1: the growth of total productivity.

5) Conclusion:

Environmental Effects of various technologies in power product depend on facilities, equipments kind of fuel and status of productivity and rate of productivity. Fur ther more depend on establish ment, position. Thermal plant that role in power generation with air pollution, water and dust, acoustic and vibrational, smell, landscape destroy and in some case light pollution do effect on human and natural environment and situation of equipment operation.

Environmental policies in many countries and institutes for law implement and national policies in order to achievement of triple purpose such as: absence of accident or incident occurrence. Don't hurt human and don't hurt to environment. In order to constant development by environmental management ways, some purpose like the decrease of air pollution (and decrease of greenhouse gas diffusion);

Deletion of any chemical material leak and dangerous wastes, productivity of energy, decline of solide or liquid waste materials, education notification and public informations, maintaining and rehabilitation of natural sources, environmental effects must consider, in other hand optimal use from sources instead of formation and initiation of new plants that need to more capital and money is very necessary for society, thus this question is necessary that with current capacity of plants increase of current power product is possible? For this purpose in this article, efficiency of plants that are beneath ministry of power that produce more than 90 percent of power product of country during the 1988-2010 examine. With data envelopment analysis approach and productivity grow with Tornqvist Productivity Index evaluated.

Total plants in current years acts in input situation into rising index. In addition fossil fuel increasing grow along the period of examination is disorderly and average efficiency of power product under estimation of constant input into index of 1955 percent and under estimation of variable input into index is 1982 percent. Results of model show that amount of power efficiency in fossil fuel consumption have irregular process mean while changes of technical efficiency and total agent of product have irregular process in this period.

Thus fossil fuel reduction planning for power product in iran. Extent and development of synthesis cycle plants, concurrent generator of power and heat product, dispersal product system, reproducible Energy source, use of Digital observant and control system and equipment with high efficiency and low mortality in power transportation and distribution department is signal of this global manner consist of deletion, fix or decrease of pollution and this important subject is special focus by power administrative industry. However consumption of fuel oil during 2000-2001 and consumption of gasoline in 2004-2008 have wast fuel consumption in power Energy Production. Thus in recent year severity of fossil Energy consumption been higher and consumption efficiency has been lower. Talking point is that contemporary with this years according to (b) line 122 paragraph of third law of economic cultural and social development based on general policies of power ministry, warranty for institution of plants grant to private sector.

The results of this study and other papers [15], suggest that Iran, like other countries of the world as part of a growing trend in the use of fossil fuels should reconsider its electricity industry. In order to achieve the objectives of the Kyoto protocol, infrastructure investments in clean energy and new do.

In order to mitigate the effects of global warming, government are being compelled by governments, investors, and customers to control their greenhouse gas (GHG) emissions. This thread has been emphasized in other studies. [17]

Where as sometimes reason of succeed for successful industry haven't one nice strategy but was conceal in good implementation of strategy, application of this Balanced Scorecard technic suggest for measurement of power productivity input.[13]

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