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Research Article

Investigating the Harmful effects of Fossil Fuel Consumption Subsides on Power Generation Costs in Iran

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Abstract
The current system of fuel consumption subsides payments of fossil power plants in Iran has initiated substantial challenges such as controversies on real price and total costs of the electricity in Iran. The main objective of this study is the calculation and assessment of the total costs of electricity generation in different existing power plants in Iran including thermal and renewable power plants on the basis of figures of real and Subsidy fuel costs using a variety of discount rate. For this purpose, the technique of electricity Levelized costs has been used. The obtained results of this study indicate when the LCOE is calculated with the Subsidy cost of fuel, the least amount of electricity generation costs applies to fossil power plants. Meanwhile, this can be considered true if the real fuel value is considered in Iran, the least amount of power generation cost will be imposed on the renewable power plants. We also showed how the investment risk in this sector will change by changing the discount rate in the calculation method. Results showed that the energy system is strongly affected by changes in discount rates. The lower discount rate is the higher the renewable contribution. Obviously, if the policy of subside payment to the state energy sector continues, the total costs of electricity generation in Iran will still be unrealistic due to unreal costs of delivery fuel to the power plants and the employment of renewable energies will not be capable of competing with fossil fuels.
Keywords: Discount Rate, Electricity Generation, Energy subsidies, Levelized costs of electricity, Renewable Power plants, Thermal Power plants.

Introduction

Iran as one of the south-western Asian countries in the Middle East possesses huge resources of fossil energy in the world (second rank concerning gas resources and fourth rank concerning oil resource (IEA, 2015; Ardestani et al., 2017). This fact has led to the present status of Iran government policies, in order to achieve the pre-planned goals, to pursue subside payment for different energy production processes and it is justified in economy and the rate of subsidies is increased annually.

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Energy in the domestic market used to be heavily subsidized. The subsidies, not only put a heavy burden on Iran's economy, they also lead to wasteful energy consumption, since the ow energy prices do not present any incentive for efficient use of energy (Ardestani et al., 2017). Subsidy is defined as any money paid by a government, in favour of recipients, in order to reduce the price of resources like energy, water and etc. for the final consumers to be less than the total economic costs (Taylor, 2020). All of these costs represent the hidden costs of production, conversion and consumption of a specific energy resource (Norman)

The subsidies can be classified according to the government's purposes of payment, the steps in which goods or services are subject to the subsidies, distribution methods, classification of financial accounts and impacts on budget (Tashkini, 2009).

Amongst subsidies paid to agricultural, fossil fuels, nuclear energy, water, fisheries and forestry, called hidden subsidies (Norman) and include all governmental support of goods and services which their expenditures are not reflected in the government budget (Tashkini, 2009).

According to the report rendered by International Energy Agency in 2018, the total subsidies paid to energy sectors in the world was 426,660 million dollars and the shares of each of the energy production processes including petroleum, electricity, natural gas and coal are 42.6, 33.5, 23.1 and 0.8 percent respectively. In addition, Iran, Saudi Arabia, China, Russia and Indonesia have been introduced as the countries with utmost subsidies payments to the energy sectors (IEA, 2019). According to the report rendered by IRENA in 2020, Total energy sector subsidies in 2050 are 25 % lower than in 2017 and 45 % lower than they would be based on current plans and policies (Taylor, 2020). In figure 1, the rates of subsidies payments to the energy sectors in Iran are provided according to the type of energy resources. The diagram clarifies, Iran obtained the first rank in the world in 2018 for subsidies payment to energy sectors which was approximately 15% of its gross domestic production (GDP) in the same year (IEA, 2019).

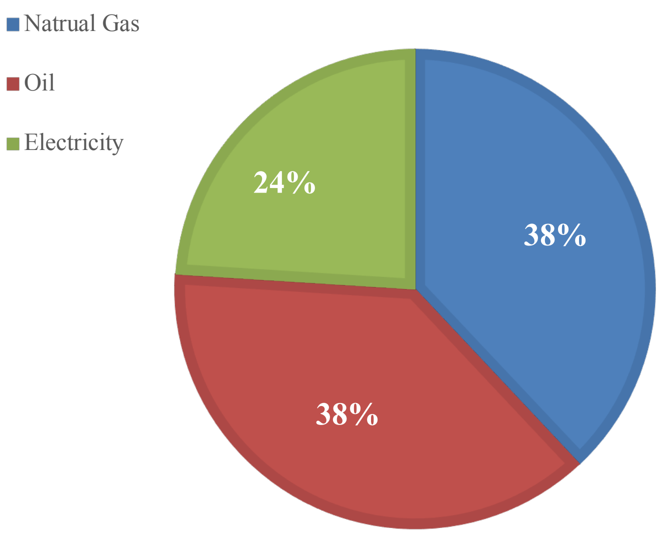

Figure 1. Subsidies Paid to the Energy Sectors in Iran in 2018 (IEA, 2019)

About 25% of subsidies paid (16,587 million dollars) in this sector is related to power generation at the fossil power plants. This has led to the low efficiency of the power plants in Iran (Ministry of Energy of Iran, 2017) and also Oil-bearing characteristic is the main reason for under development in using renewable energies (Shafiei Nickabadi et al., 2021). In the following table, the rates of consumption of fossil fuels as well as the efficiency of thermal power plants are provided.

Table 1. The Rates of Consumption of Fossil Fuels and Efficiency of Thermal Power Plants in Iran in 2018 (Ministry of Energy of Iran, 2018)

Type	Consumption of Fossil Fuels		EF (%)
Steam	Gasoline (million Lit)	70	36.6
	Gas (million m3)	20244	
	Fuel Oil (million Lit)	3572	
Gas	Gasoline (million Lit)	2190	31.4
	Gas (million m3)	21265	
Combined Cycles	Gasoline (million Lit)	3811	45.8
	Gas (million m3)	26235	
Diesel	Gasoline (million Lit)	23	34.7

In accordance with the latest published statistics, the net production of electricity with the assistance of a combination of different existing technologies (fossil, renewable and nuclear) in 2018 was about 310945 Gwh (Ministry of Energy of Iran, 2018). Of these, the combined cycle power plants have allocated the highest rate of electricity generation, but diesel power plants, the lowest rate of power generation among the fossil power plants. In table 2, the amount of electricity generated in Iran based on the type of power plant is given separately.

Table 2. Electricity Generation in Iran in 2018 (Ministry of Energy of Iran, 2018)

Type	Electricity Generation (Gwh)	Share (%)
Steam	86312	27.8
Gas	70861	22.8
Combined cycle	129585	41.7
Diesel	80	0.03
Hydroelectric	15983	5.1
Nuclear	7486	2.4
Renewable	638	0.2
Total	310945	100

In spite of the fact that there is a high potentiality for the consumption of different resources of renewable energy for electricity generation regarding their geographical location in Iran, the rate of employing theses resources in 2018 has reached almost 5% (including hydroelectric power plants), and the highest burden of electricity generation in Iran is undertaken by fossil power plants (Ministry of Energy of Iran, 2018).

The significant point is that devoting subsidies for consumable fossil fuels in electricity generation industry can also have long time negative impacts on the economy, ecosystem and society (Carolina; Carolina, 2015; ESMAP, 2017).

In this study, the objective is to investigate how these subsidies can influence the diversion financial activities in Iran? Of course, answering this question is difficult, but in this study, we intend to analyze this subject by using the calculation and comparison of total costs of power generation in various fossil and renewable technologies by utilizing levelized cost of energy (LCOE) model and different economic scenarios. Therefore, innovation in this research includes the cost price of electricity generation for various technologies has been done together and with the LCOE method. This method is able to show the real cost of electricity generation with its assumptions and show the effect of each parameter on these costs well. The parameters of this model have been changed using different assumptions during different scenarios and the effect of each on the cost of electricity has been determined and compared and analyzed.

The LCOE is a very important metric in determining whether or not to move forward with a project. It allows for these comparisons regardless of unequal life spans, differing capital costs, size of the projects, and the differing risk associated with each project (CFI, 2021).

One of the most fundamental pieces of information for establishing the planning system of power generation in Iran and optimizing probable alternatives is the total costs of power generation by every single existing and available technologies.

So far, many studies have been conducted on the effects of fuel subsidies on electricity prices around the world. For example, Bailey (2012) has studied LCOE in various power plants. This study compares the levelized cost of electricity generated with fossil fuels (including coal, natural gas, fuel oil, and diesel) and renewable or carbon-free energy sources (including hydro, wind, solar, nuclear and geothermal). A meta - study of power generation technology capital costs have determined the range of capital costs across the various technologies as well as the range of cost estimates for each individual technology from the various data sources that were examined. Applying these capital costs to a range of operating assumption (such as fuel price and plant utilization rate) has resulted in a range of levelized cost of electricity for each technology. Asadi et al (2017), In their study, they compared the cost of generating geothermal electricity with existing fossil fuels and it has been suggested that fuel price liberalization and the inclusion of external costs in calculations have a significant effect on the development of geothermal energy. Zandi et al (2017), Calculate the cost of generating electricity in Iran's thermal power plants with subsidized fuel and free fuel. They compared and concluded that if fossil fuels are delivered to power plants at a subsidized or free price, the difference in the cost of electricity generation will be very significant and the price of fuel delivered to power plants in the total annual cost of electricity production in the country. It is very decisive.

So, the variety of Electricity generation methodologies in parallel with the noticeable economic consequences would enhance the necessity of primary studies and precise planning for choosing the most appropriate method of power generation for long term power industry in Iran and without precise and multilateral studies, we cannot achieve an appropriate combination of numerous methods of power generation and their contributions in providing national needs basket for the relevant divisions.

In fact, the total costs of electricity are one of the effective signals in decision making and planning which can assist to represent the role of paid subsidies for the consumable fossil fuels in thermal power plants and indicate the importance of precise planning for better and more efficient utilization of technologies of electric electricity generation.

Material and Methods

To calculate the total costs of the electricity generation by using any one of the technologies, a holistic strategy during the existence of the plan of power plant technology has been recognized. In this strategy, the sum of the fixed and variable costs of the periods including the implementation and utilization costs will be investigated.

Moreover, due to occurrence of costs during different years and the necessity of considering the value of time for total costs by utilizing the techniques of engineering economy, the sum of the costs of the items will be converted according to the base year and included in the calculations (Sieglinde, 2016). Since according to the existing review of literature, the most common method of calculating the total costs of electricity at power plants is considered as the levelized costs of electricity method and its usage is highly attended in this study.

Introduction of LCOE Model

The levelized costs of energy is a method for calculating the current value of costs of investment and utilization of electricity generation during the whole time period of the existence of the project (U.S. Energy Information Administration, 2015; Pawel, 2014; DECC, 2012; EIA, 2021) in which the cost of generating one kwh of electricity is calculated by dividing the current value of the total costs of electricity generation (U.S. Energy Information Administration, 2015; Pawel, 2014; EIA, 2021) The main relation for calculation of levelized costs of energy is as following:

$$LCOE = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+i)^t}} \quad (1)$$

The Important Amounts and Parameters for Calculation of LCOE

The important parameters and inputs in relation (1) are as follows (Danish energy agency, 2019). It is worth mentioning that the relation and calculation method of every single parameter are presented in this section.

1- Initial investment costs in year (*t*) which it is presented as I_t. The relation for calculation of investment costs for different years will be calculated as follows:

$$I_t = I_{Total} \times \frac{i \times (1+i)^n}{(1+i)^{n-1}} \quad (2)$$

In this study, the costs of primary investment for the construction of power plant are shown based on Euro/Mw (I_{Total}) for different power plants. In equation 2, *i* is the rate of discount. In the continuous of this essay (clause 5), some remarks will be presented about the calculation of rate of discount.

In table 3, the assumptions of costs of primary investment are presented with regard to the capacity of different power plants and the existing resources in Iran.

Table 3. Investment Cost and O&M Costs of Different Methods for electricity Generation (Renewable energy Organization of Iran, 2018).

Type	Technologies	Investment Cost (€/kw)	O&M Costs (c€/kwh)
Solar	PV	650-1000	0.1-5.5
Wind	Onshore	850-1400	0.1-5
	Incineration	1700-3600	2.7-8
Biomass	Gasification	1616-4300	3-10
	Anaerobic digestion	2350-3100	5-5.5
Geothermal		2200-4000	2-2.5
Hydroelectric	Small	1600-2190	2
	Large	1400-1500	1-1.5
	Gas	360-440	3.5-4
Thermal	Steam	467-1100	2.4-5
	Combined cycle	560-850	2.3-3.4

2- The Operation and Maintenance (O&M) cost for the system per year (*t*) which it is shown with M_t. The Operation and Maintenance (O&M) cost for the power plants are divided into two sectors of the fixed costs (a percentage of the costs of primary investment in a year) and the variable costs (depending on the generated electricity) which are presented based on Cent Euro/kwh in table 3.

3- The costs of providing fuel in year t is shown with F_t and will only be calculated for the power plants with fossil fuels. The costs of fuel will be calculated through the following equation:

$$F_t = \frac{E_t}{w} \times F \quad (3)$$

At this equation, *W* is the efficiency of energy conversion according to the percentage at the thermal power plant. The average rates of efficiency are presented for each types of power plants using fossil fuels in the table 1. The rate of electricity generation for every system in the year *t* is shown with E_t. Its calculation method is presented in item 4 of this essay.

F is the price of fuel unit for the generated energy according to the Rial/kwh which is converted to the Dollar/kwh with regard to the rate of exchange equivalence.

It is worth mentioning that the discussion about fuel subsidies payment in the sector of electricity generation has caused the several important problems in the accuracy of required estimations. Therefore, sum of subsidies fossil fuel required for the electricity generation is presented in table 4. In order to enhance the accuracy of estimations regarding the specification of the real price of generated electricity in Iran, the real price of fuel without subsidies will be considered as an independent scenario and its assumptions will be described in table 5.

Table 4. Price of subsidies fuel at thermal power plants in Iran in 2018 (Ministry of Energy of Iran, 2018)

Type	Price of fuel
Gasoline (c$/lit)	1.3
Gas (c$/m3)	0.6
Fuel Oil (c$/m3)	0.9

The average exchange rate of Rial to Dollar in 2018 is considered IRR 9,250 per Dollar (Central bank of Islamic Republic of Iran, 2018).

Table 5. Price of real fuel at thermal power plants in Iran in 2018

Fuel	Resources	Price of
Gasoline (c$/lit)	FOB	62
Gas (c$/m3)	PC [1]	10-13.7
	A12 [2]	13
	E [3]	23-49
	FOB	62
Fuel Oil (c$/m3)	FOB	60

[1] The price of gas has been determined according to the petroleum inputs and outputs capacity for possibility of oil export (Bahonar, 2017).

[2] The price of gas is specified according to Article 12 of Act on Production Obstacles Lifting such as the rate of saving, which accordingly, the government is obliged to pay the investors contributing in the plans of fuel reduction, equal to 13 cent of dollar per cubic meter of natural gas, in order to increase the efficiency of electricity houses (Ministry of Economic Affairs and Finance, 2016).

[3] The price of gas has been determined according to the price of exporting gas. The utmost exports were to Turkey (49 cent dollars per cubic meter) and has always faced some changes resulting in the reduction of price (23 cent dollars per cubic meter) (Supreme Audit Court, 2017).

4- The rate of electricity generation for each system in year *t* are presented with E_t in equation 1. The rate of electricity generation at different power plants is calculated through the following equation:

$$E_t = P \times FLH \times D \times CPF \quad (4)$$

In equation 4, (*P*) represents the rate of maximum capacity of power plant according to MW; (*FLH*) represents the electricity generation in each year according to hour and hours with full load; (*D*) represents the rate of annual depreciation of the equipment; (*CPF*) represents the co-efficiency of capacity of power plants for electricity generation.

It is worth mentioning that the rate of equipment depreciation and co-efficiency of capacity of power plants will be different depending on the types of power plants and geographical locations of the countries. In table 5, aforementioned rates are presented. Moreover, the intended operating hours of the power plants is equal to 8760 hours per year.

Table 6. Depreciation and co-efficiency of capacity of different power plants for electricity generation in Iran

Resources	Type		D (%)	CP (%) *
Renewable	Solar		0.5	25
	Wind		0.5	36
	Biomass	Incineration	0.5	73
		Gasification	0.5	70
		Anaerobic digestion	0.5	73
	Geothermal		0.5	85
	Hydro electric	Small	0.5	38
		Large	0.2	35
Thermal	Steam		0.7	70
	Gas		0.7	85
	Combined Cycle		0.7	85

* The rate of co-efficiency of capacity at the power plants with regards to the statistics of real electricity generation in Iran and its investigation and analysis by Renewable Energy and Energy Efficiency Organization is obtained.

5- The rates of discount or time priority are the interest rates which convert liquidity future process to the present time and is shown with *I* (Melina et al, 2012). Also known as the cost of capital or required rate of return, it estimates current value of an investment or business based on its expected future cash flow. Considering the time value of money, the discount rate describes the interest percentage that an investment may yield over its lifetime (Henricks, 2021).

Due to the importance of accurate determination of discount rate in choosing different options for the power generation, in this study, the discount rate, which manifests the point of views of the private and governmental investors in Iran, is used in the projects of energy sector which is estimated by one of the following methods:

- The discount rate is considered equal to maximum profit rate without risk (profit rate of long-term bank deposits and/or Bonds in Iran), in addition to several percentages to cover the risk of investment of plans.

In this case, to calculate the discount rate, the following equation is used:

$$i = R_f + (RP_m + RP_i) + \quad (5)$$

$$RP_m = R_m - R_f \quad (6)$$

$$RP_i = R_i - R_m \quad (7)$$

R_f: Interest Rate and without risk in bonds from the government
RP_m: Difference between Internal rate of return in the market and Risk-Free Rate of Return
RP_i: Difference between Rate of return in electricity industry and Rate of return in market
CRP: Investment Risk Index (%)

The presented amounts for discount formula mentioned above are described in table 7.

Therefore, considering the presented equations and figures, the discount rate in this sector are 17.5 % and 7% in the top and bottom scenarios.

Table 7. Amounts of calculation criteria for discount rate in first and second scenario

Index	Amount (%)
Rf	8 [1]
Rm	(23-17.5) +2 [2]
RPm	- 0.5 [3]
RPi	±5 [4]
CRP	5 [5]

[1] Is equal to profit rate of foreign exchange partnership notes in facilities of National.
[2] Domestic efficiency rates in market equal to the efficiency rate of promissory notes in Tehran Stock Exchange after deduction of average of inflation rate in Iran and increasing value of dollar value during the previous years.
[3] Similar to the previous row.
[4] Is equal to ±3% of the markets efficiency with regard to lack of information about the amount of efficiency in the investment of the sector of electricity generation in Iran.
[5] According to the ranked numbers of credit risks of the countries, and their comparison with countries with similar economic conditions with Iran: Such as Ecuador, Egypt, Ghana, Georgia, Kazakhstan and etc. (Country risk classification of the participants to the arrangement on officially supported export credit, 2018).

In the other method, the discount rate is estimated to be equal to the rate of adjustment co-efficiency and calculated according to the following equation:

$$MF = \left(\frac{CPI_{\,(base\,year)}}{CPI_{(target\,year)}}\right)^{\propto} \times \left(\frac{ER\,€_{\,(base\,year)}}{ER\,€_{\,(target\,year)}}\right)^{1-\propto} \quad (8)$$

In this equation, *CPI* is the index of consumer price, and *ER* represents the foreign exchange rate. Given that the average changes of consumer price index are 17.5% (Central bank of Islamic Republic of Iran) and changes of Euro foreign exchange index is 12.5% (Central bank of Islamic Republic of Iran) and amount of alpha is 0.3, so the amount of co-efficiency of adjustment will be equal to 14%.

6- Life time of each systems of electricity generation according to year, is shown with n. In the below table, life time of different systems for electricity generation in Iran which are intended in this study has been provided.

In renewable power plants, the life time of the systems for electricity generation are different. Since the policies for the guaranteed purchased power are being implemented in Iran for 20 years, the life time of the mentioned systems are considered until the end of life time of guaranteed purchased electricity.

Table 8. Life time of Systems for electricity Generation in Iran

Resources	Type		Life time (year)
Renewable	Solar		20
	Wind		20
	Biomass	incineration	20
		Gasification	20
		Anaerobic digestion	20
	Geothermal		20
	Hydroelectric	Small	20
		Large	20
Thermal	Steam		30
	Gas		20
	Combined cycle		30

Results and Discussion

In figures 2 and 3, the obtained results of calculation of the balanced electricity costs in Iran are determined and presented in two scenarios of real fuel and subsidy fuel with regard to above-presented assumptions and in the calculations of different scenarios of discount rate.

As presented in the figures 2 and 3, in the electricity generation from the fossil energy resources of combined cycle power plants is much cheaper than other energy resources. The gas resource has the second rank. Meanwhile the most expensive resource is related to heater power plants.

Considering the real fuel costs in Iran, the lowest costs of private electricity generation from the fossil and renewable energy resources include wind, solar, incineration, large hydroelectric, geothermal, anaerobic digestion, gasification, small hydroelectric, combined cycle, gas and steam energies (figure 2).

Considering these results, since the renewable power plants on one hand, need the high initial investment, but lower costs for repair, maintenance and operation with respect to other power plants in Iran, are presented as the lower level in ranking, among the costs pf private renewable power plants versus fossil power plants.

Moreover, on the other hand, the renewable power plants will not encounter any sudden changes in the total costs of the electricity generation during the passage of time because of not using the fossil fuels and will undergo much lower costs.

As a result, if the real price of fuel id considered in the calculations of private electricity generation costs, and the destructive effect of high subsidies to this sector deleted, we will access to more real prices than costs of electricity generation. This fact will reveal the existing difference in price among the fossil power plants and the renewable power plants.

Obviously, with continuity of subsidy payment policy to the state energy sector, the total price of electricity will not still be tangible due to unreal costs of delivery of the fuels to the power plants, and in the fossil sector, the costs of electricity generation will be artificially much lower than the renewable energy. Therefore, the employment of renewable energies will not be able to compete with the fossil fuels. So, energy subsidies represent a key barrier to the development of renewable energy in the region (Taglhapiet, 2016).

This is an important point to consider, Energy subsidies can be either beneficial or damaging to the environment. Damaging subsidies are those that lower the price of behavior that is detrimental to the environment, for example encouraging excessive energy consumption, or making the cost of more environmentally harmful fuels lower relative to those that are less harmful. In contrast, subsidies that are beneficial to the environment improve the competitiveness of environmentally sound practices by reducing their price relative to those that damage the environment (European Environment Agency, 2004). On the other hand, the same fact has caused to descend the efficiency of these power plants to be much low and has always faced the damages, which the requirement for promoting the efficiency is not sensible.

That is why the destructive impacts of subsidies payment to the electricity generation sector in Iran can cause the resources of fuel in Iran can cause the irreparable damages to the economic and environmental sectors of Iran.

On the basis of the proposed results in figure 2, by considering the effects of subsidies on the state electricity sector, the lowest costs for the private electricity generation from the resources of fossil energy includes gas, combined cycle, steam, wind, solar power plants and etc.

Subsidy reform can level the playing field for renewable energy. It can also create incentives for investment in energy efficiency by sending the right price signals. All these factors are critical for achieving access to energy for all, as shown in the results of this study.

Another significant fact is the relationship of the obtained findings from the manner of calculating discount rate in Iran. Indeed, the risk of investment in calculations of the balanced costs of electricity highly depends on the manner of calculation of the discount rate (figures 2 and 3).

Given that the renewable power plants in Iran undergo high costs of initial investment and their costs of repair and maintenance in comparison with fossil fuels power plants are very low. In addition, no costs for providing fuel will be paid; as a result, the electricity balanced costs for the renewable power plants strongly depends on the discount rate and costs of initial investment.

By investigating more accurate analysis of the experimental information in this field, it is observed that using this rate with the least amount has caused to represent the balanced costs of electricity to be lower and by increasing the balanced costs of electricity to be higher. This case is proved at many studies (Sergei, 2013; Larsson et al, 2014; Ouyang and Lin, 2014)

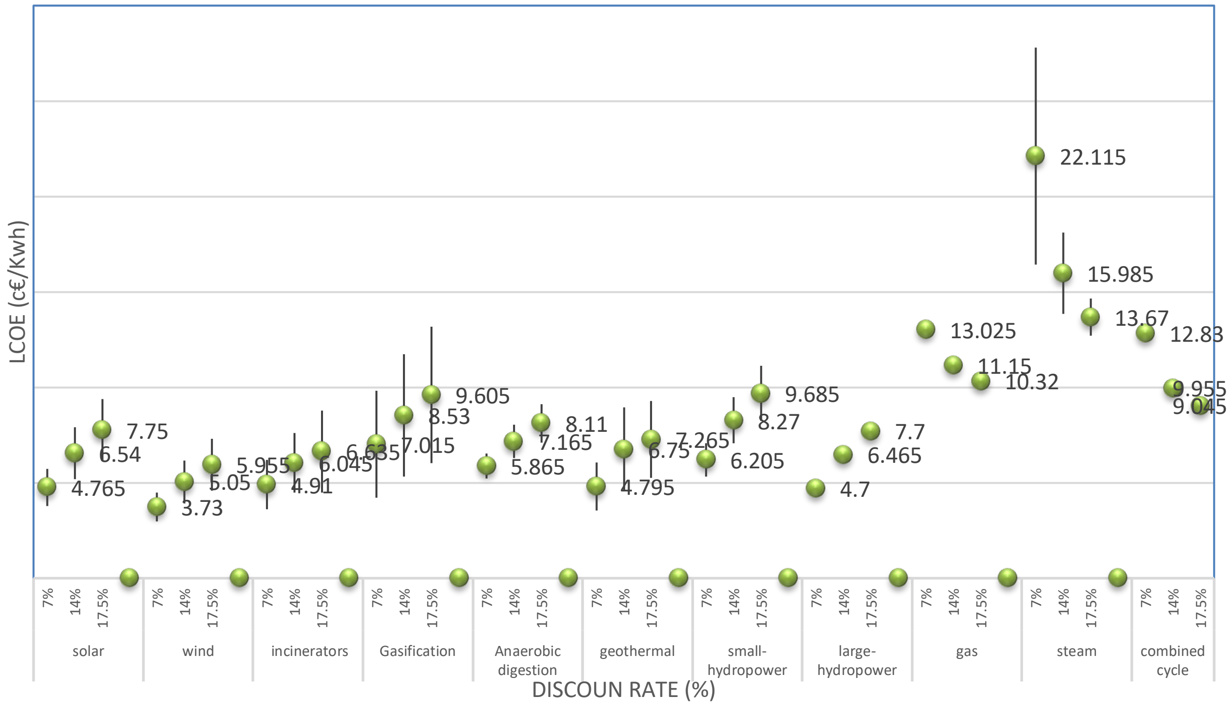

Figure 2. Levelised cost of electricity in type of technologies (Real price of fuel)

In this study, as described, the different scenarios are used for the discount rate and the highest usage for precise calculation will include the investors who are interested in entering to the renewable energies market in Iran and are unpleasant with paying high subsidies to the sector of energy. Discount rates have important policy implications as they can be used to predict consumers' decisions under a policy and thereby help to evaluate its impact (Train, 1985).

The results of this study will increase by increasing the discount rate of balanced amount of electricity costs for different renewable power plants and decrease for the power plants with fossil fuels.

In fact, the higher discount rate will cause the higher price of electricity generation considerably in future and renewable projects with known high costs of investment and will be less attractive for the investors. Indeed, the low discount rate signals low rate of financial risk for the relevant projects of electricity sector (Sergei, 2013; Chunekar and Singh Rathi, 2012; GarciaGusano et al., 2016).

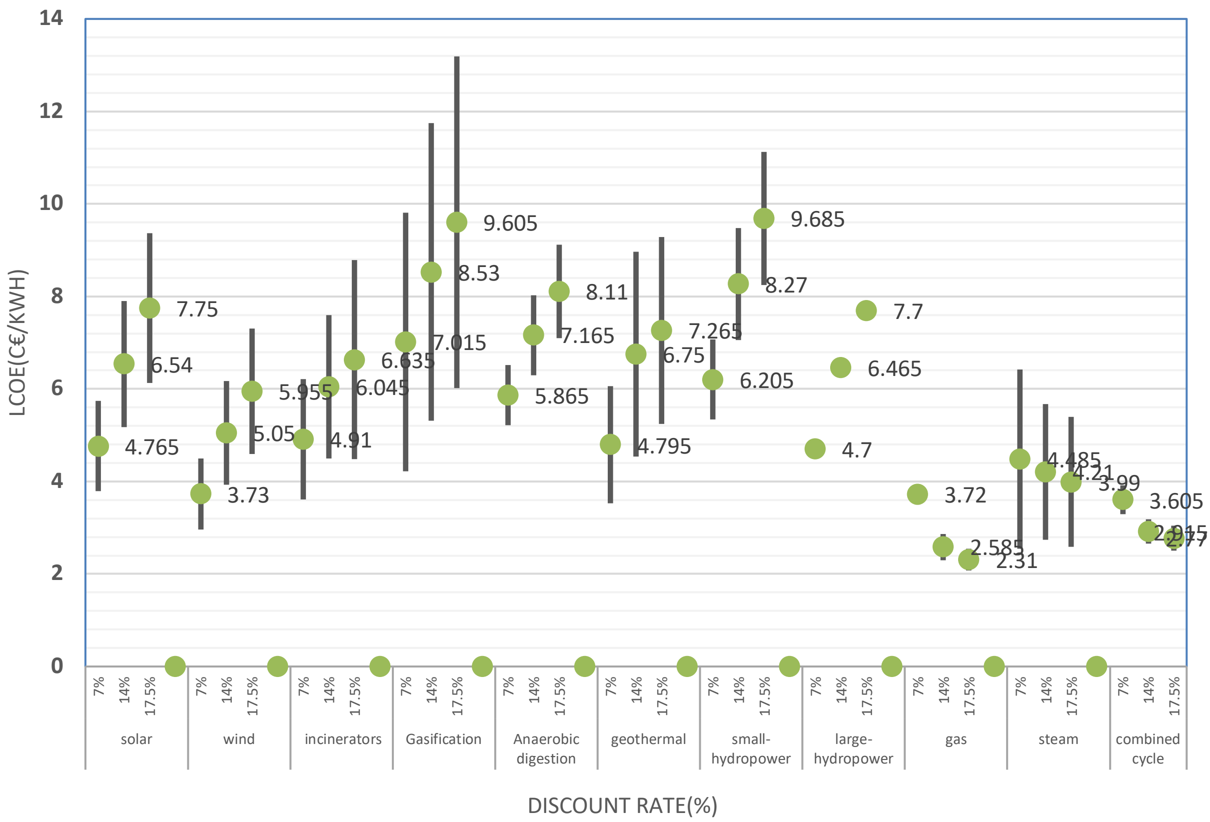

Figure 3. Levelised cost of electricity in type of technologies (Subsidy fuel)

Results showed that the energy system is strongly affected by changes in discount rates. The lower discount rate is the higher the renewable contribution. The discounting extras influence on capital intensive investments so it is quite important to look at the energy carriers' pathways (fossil-renewable transition).

probably, the most important reason of this fact is the costs of providing fuel at the power plants with fossil fuel which every year increases according to the official inflation rate of Iran. In all calculations, the annual increase of fuel price is considered 14% which it is equal to the average of annual inflation rate in Iran from 1990 to 2018. So, determining the appropriate discount rate is the key to properly valuing future cash flows, whether they be earnings or debt obligations (Fernando, 2021).

However, the development and usage of the renewable energies regarding the existing potentials in Iran, in addition to positive economic effects, causes to decrease the diffusion of greenhouse gases. Using renewable energy is a solution to reduce fossil fuel consumption (Sadeghi and Vahidi, 2020). Therefore, the high costs and existing of fossil fuel subsidies are a key limiting element for the development of this kind of energy. As a result, the accurate calculation of discount rate and its employment in total price of electricity for Iran, on one hand, is considered vital, but on the other hand, we will face the subsidies payment to this sector in the country.

Therefore, the estimation of real price of electricity generation must be investigated multilaterally to that it can be a suitable support for the investors of this field. For this purpose, it is suggested to consider subsidies to the renewable sectors the same as the fossil sectors to assist to reform the price system of this kind of energy resource in the country. Of course, up to now, some measures have been taken by the Renewable Energy and Energy Efficiency Organization of Iran in this regard under the title of guaranteed purchase of electricity from the renewable resources, but we have not witnessed any significant growth in the power generation development.

Conclusion

This study is performed with the purpose of assessment and calculation of the total electricity costs at the different existing power plants in Iran to investigate and present the risks of energy subsidies payment to the fossil fuels in Iran through the model of balanced electricity costs.

The subsidies are one of the economic instruments which the governments interfere in the market to achieve the intended purpose. The most significant consequences of subsidies payment in microeconomics are to decrease the rough prices in the economics, distortion of prices and eventually, non-specifying optimal resources. As a result, the negative environmental, economic and social impacts will affect the countries considerably. The subsidies have macro effects on the national economy by making budget deduction and increasing social costs. This fact is fully transparent by calculating balanced electricity costs in Iran as well.

As the results have indicated, the least amount of electricity generation costs is related to the fossil fueled power plants and the renewable resources will not be able to compete with them. However, if the power plants are obliged to pay the real costs of consumed fuel, then, the renewable power plants will Undergo lower costs for the electricity generation and are authorized to be in priority in the development plans, and in case of continuity of supportive policies by the government through the subsidy payment for the fuel, the balanced electricity costs will be strongly influenced. This will cause a drastic change in possible alternatives in the development plan for the electricity generation in future.

On the other hand, if the transparency in the economy increases and the intervention of government decreases in the price system of electricity generation, the deviation of investment will decrease too. A review of this subject indicated that in the view of policy making, the assessment of costs of power generation should be more transparent and broader and possess a valid scope.

Consequently, reformation of subsidies payment system for fossil fuels in Iran permits us to benefit from the appropriate economic, financial, social and environmental effects of the deletion of the current subsidies and any change in this structure will create the required incentives for lifting obstacles of investment and assist the achievement of stable development goals. Of course, for the purpose of long-term planning, the mere total costs of electricity generation will not be the benchmark and other parameters such as restriction of employment of these energy resources, land, human powers, capital, technology and etc. should be regarded.

It is worth to be noted that basically assessment of indirect costs in electricity generation are ignored which is analysis could influence the totality of assessment system and reveal the role of destructive and hidden subsidies. Moreover, other parameters like life time of system and discount rate with the fuel price are also significant which in this study, the role of discount rate has also been investigated and as it was indicated the impact of discount rate in calculations cannot be ignored and with the lower rate of discount, the cost of electricity generation will reduce because of the competition between the markets interest rate of market which has sooner outputs and not ignoring the future environmental consideration.

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